NINETEENTH YEAR OF PUBLICATION.

SCOTTISH CLUB, 39, Dover St., Piccadilly

JOURNAL OF SCIENCE,

AND ANNALS OF

ASTRONOMY, BIOLOGY, GEOLOGY, INDUSTRIAL ARTS, MANUFACTURES, AND TECHNOLOGY.

(MONTHLY, FORMERLY "THE QUARTERLY JOURNAL OF SCIENCE.")

Vol. IV. (THIRD SERIES)
No. CII.

JUNE
1882.

CONTENTS.

ARTICLES. PAGE

1. The Philosophy of Thomas Carlyle. By C. ARDEN .. 313
2. Charles Darwin: a Farewell Offering. By AN OLD DISCIPLE OF LORENTZ OKEN .. 322
3. Vegetable Soil. By G. H. KINAHAN, M.R.I.A., &c. .. 331
4. Epping Forest from a Naturalist's Point of View. By FRANK FERNSEED.. 341
5. The Exploration of Palestine 346
6. Notes of Experiments on the Action of Coloured Light on Carp 350

ANALYSES OF BOOKS.

Dyeing and Tissue Printing .. 353

ANALYSES OF BOOKS—*continued.* PAGE

Private Instructions in the Science and Art of Organic Magnetism 356

"Two Planets beyond Neptune," 1875, and "On some Properties of the Earth," 1880 358

Spon's Encyclopædia of the Industrial Arts, Manufactures, and Commercial Products 361

British Fresh-Water Algæ, exclusive of the Desmidiæ and Diatomaceæ 363

Anecdota Oxoniensa, Texts, Documents, and Extracts 364

Land Nationalisation 365

&c., &c.

CORRESPONDENCE. NOTES.

LONDON:

3, HORSE-SHOE COURT, LUDGATE HILL.

Where Communications for the Editor and Books for Review may be addressed.

PRICE ONE SHILLING AND SIXPENCE.

[The Articles and Reports in this Journal are Copyright.]

MR. THOS. BLYTON, as Agent for the following, will be happy to forward illustrated price lists *post free* on application to him at 38, Great Russell Street, Bloomsbury, London, W.C.

ALBO-CARBON LIGHT.—Reduces Consumer's Gas Bill one-half, and produces an Unequalled Light for Softness, Brilliance, and Steadiness. Generators for fixing to existing gas-fittings from 7s. 6d.

RUBBER HAND-STAMPS and METAL-BODIED RUBBER-FACED TYPE.—Universally used in Government Offices, Public Companies, Corparations, Mercantile Houses, Institutions, and Private Life, for Autographs, Monograms, Trade Marks, &c, Climax Dating Stamps, 25s. complete. Compass Pocket Stamp, 7s. 6d. Special designs to instructions.

LAYTON'S PIANOFORTES.—Warranted for Excellence of Workmanship and Finish, Quality of Materials, Brilliancy of Tone, and Easy Touch, combined with Moderate Prices. Superior Instruments from 36 Guineas, or on Three Years' System from 2½ Guineas per Quarter.

LOSS OF TIME IS LOSS OF MONEY!

ACCIDENTS CAUSE LOSS OF TIME,
And may be provided against by a Policy of the

RAILWAY PASSENGERS' ASSURANCE CO.

The Oldest and Largest Accidental Assurance Company,

ASSURANCE AGAINST ACCIDENTS OF EVERY DESCRIPTION.

Right Hon. LORD KINNAIRD, Chairman.

Subscribed Capital, £1,000,000.

ANNUAL PREMIUM.				*COMPENSATION.*		
CLASS I. Ordinary Risks.		CLASS II. Hazardous Risks				
Total Disablement.	Total and Partial Disablement.	Total Disablement.	Total and Partial Disablement.	Sum Insured in Case of Death.	Weekly Allowance for Total Disablement by Injury.	Weekly Allowance for Partial Disablement by Injury.
£ s. d.	£ s.	£ s. d.	£ s. d.	£	£ s. d.	£ s. d.
0 10 0	0 12 0	0 16 0	0 18 0	100	0 15 0	0 3 9
1 0 0	1 5 0	1 12 0	1 17 0	250	1 10 0	0 7 6
1 15 0	2 5 0	3 3 0	3 13 0	500	3 0 0	0 15 0
3 0 0	4 0 0	5 5 0	6 5 0	1000	6 0 0	1 10 0

Apply for prospectus and full particulars to T. BLYTON, 38, Great Russell Street, Bloomsbury, London, W.C.

A High-Class Spiritualist Journal.

LIGHT:

A WEEKLY JOURNAL DEVOTED TO THE HIGHEST INTERESTS OF HUMANITY BOTH HERE AND HEREAFTER.

"LIGHT! MORE LIGHT!"—*Goethe.*

The Contents of the paper comprise :—(1). Original Articles on the Science and Philosophy of Spiritualism. (2). Records of Facts and Phenomena, both Physical and Mental. (3.) Miscellaneous Literature connected with the movement, including Poetry and Fiction. (4). Reviews of Books. (5). *Resumé* of the Periodical Press, both British and Foreign, devoted to Spiritualism and allied subjects. (6). Questions and Answers.

Price 2d., *or* 10s. 10d. *per annum, post free.*

London : E. W. ALLEN, 11, AVE MARIA LANE, E.C.

owing,
s *post*
Street,

alf, and
adiness.

BBER-
, Public
ate Life,
ps, 25s.
tions.
Work-
ne, and
ts from

!

CO.
any,
PTION.

Russell

IEST
AFTER.

Science
na, both
vith the
Resumé
ism and

E.C.

XUM

THE SCOTTISH CLUB, 39, Dover St., PICCADILLY

THE

JOURNAL OF SCIENCE.

JUNE, 1882.

I. THE PHILOSOPHY OF THOMAS CARLYLE.*

By CONSTANCE ARDEN.

"L'idée de Dieu est une forme de l'idée de l'infini."—M. PASTEUR.

"Le but du monde, c'est l'idée; mais je ne connais pas un cas où l'idée se soit produite sans matière."—M. RENAN.†

THE distinction between deductive and inductive systems of philosophy is best represented by their practical interpretation of the terse command "*Know thyself.*" To the former it means—"Look inward; take what seems best or most beautiful in thine own mind, and proclaim that as the Law of the Universe." The latter replies—"Not so. Look outward; by unwearied research and rigorous analysis investigate the succession and coexistence of physical phenomena; then turn inward, and apply the same method of inquiry to mental phenomena, noting their observed connection with the material world; till at length all seemingly heterogeneous knowledge is welded into one homogeneous and organic unity."

Doubtless all thought is originally deductive; that is, it must begin by assuming the validity of certain primary mental operations. To reason in defence of reason is to perpetrate a *petitio principii;* to reason against reason is to commit suicide. It is also true that colours, sounds, and odours, as perceived by us, are creations of the brain,—phantoms not less ideal than the flimsiest metaphysical abstractions. But impressions which succeed each other in a certain irreversible order, coexist according to certain fixed

* Thomas Carlyle: a History of the first Forty Years of his Life. By JAMES ANTHONY FROUDE, M.A. Longmans and Co.

† Discours de Reception de M. Louis Pasteur. Réponse de M. Ernest Renan (Séance de l'Académie Française du 27 Avril, 1882). CALMANN LÉVY, Editeur. Paris, 1882.

laws, and are practically the same for all mankind, afford a far surer field for observation and experiment than those intricate, fluctuating, and apparently capricious states of consciousness, differing widely in each individual, which we denominate thought and emotion. To arrive at a sound conclusion we must eliminate, as far as possible, all mutable elements, and fix our attention upon the constant and stable residue. Having attained some comprehension of the simple and regular, we may hope in time to understand the complex and variable order of things. This is the only rational method of all true science in every age, and must be adopted by the moralist and historian, not less than by the chemist, physician, and astronomer. Only the poet may still delight us with revelations of that purely subjective truth whose evanescent glory—not visible to all, not constantly realised even by its creator—depends less upon value of substance than upon perfection of form. Poetry may be personal; philosophy (world wisdom*) must be universal. He who, in these days, forgets or wilfully ignores this distinction has failed to master the characteristic lesson of his epoch. His very earnestness will exercise a reactionary influence upon contemporary speculation and progress, by fettering living emotion to dying or dead thought.

The noblest recent representative of this reactionary obscurantism is faithfully pictured in the volumes before us. Mr. Froude has executed his tragic task in so sympathetic, yet so impartial, a manner, that we become more intimate with Carlyle than with the hero of perhaps any other biography of our century. No detail of temperament, of constitution, and of habit is unimportant, since all were factors in the growth of his mind; but our attention must here be confined rather to the completed philosophy than to its process of development. What we learn of his belief is briefly this†:—He held that all religions have been evolved from human experience, shaped by intellect, and coloured by feeling and imagination. No special revelation has ever been delivered; no special miracle ever performed. The natural and the supernatural are one, and their course is immutable. Man has in all ages created and uncreated his deities; but if gods are illusions, God is "the fact of facts." The constant forces of Nature are manifestations of the Divine will, and are distinguished as not "mechanic," but "dynamic" energies. It is not difficult to discover the

* *Weltweissheit* of the Germans.

† See especially Mr. Froude's masterly Synopsis of the Carlylean Doctrine at the commencement of Vol. ii.

general signification attached by Carlyle to these terms, although their antithetic use is radically unscientific and inaccurate. With him the machine is the antithesis of the organism, for he fails to perceive that both organism and machine are alike members of the universal Family Automata. Broadly speaking, he regards Nature as inspired, not impelled,—as a growth, not a contrivance,—his view being essentially a protest against the Theism of Butler and Paley, which finds its most noteworthy expression in the argument from Design. Analogical inferences are discarded for an appeal to intuitive sympathy. Man is not bidden to compare Nature with Art; he is exhorted to disregard detail, and to recognise in the pervading cosmical vitality a glorified prototype of his own higher life. God is no longer without, but within; no longer transcendent, but immanent. "For Matter, were it never so despicable, is Spirit, the manifestation of Spirit; were it never so honourable, can it be more?"* Earth and Heaven are the "Time-vesture of the Eternal"—no lifeless textile fabric, but a sentient garment of incarnate Deity. The Pantheism thus summarised, if lightly held as a sublime hypothesis, need not be inconsistent with scientific Materialism. It unifies the psychical and the physical,—the Nous and the Hyle,—and all beside is a mere question of nomenclature. If the dust of the earth, and therefore the body of man, is divine, no separable soul is necessary or conceivable. Save to the vulgar Dualist, who believes in an *external* Deity, it can signify little, at least in theory, whether we name our "first cause" Matter or Spirit, save that the former is a modest confession of ignorance, the latter an arrogant affectation of supreme knowledge.

But Carlyle's mental atmosphere was dim, and the objects of his thought ill-defined, as though seen through the floating clouds of smoke which issued so copiously from his pipe. He never gained a clear vision of his own creed. "The theories which dispensed with God and the soul"—which refused to proffer explanations of what he himself had confessed to be inexplicable†—Carlyle utterly abhorred. Physical Science, and what he called the "mud-gods" of the age, he regarded with ignorant disdain; Materialism was to him the "Gospel of Dirt." A perplexed disciple might well inquire, Must we then take "dirt" as the type of

* Sartor Resartus, Book I., Chapter X.

† "This Dreaming, this Somnambulism, is what we on earth call Life, wherein the most indeed undoubtingly wander, as if they knew right hand from left; yet they only are wise who know that they know nothing."—*Sartor Resartus*, Book I., Chapter VII.

Matter, merely because unscientific housewives apply that name to certain disagreeable, but necessary, material forms?* To the Pantheist dirt is a manifestation of the Deity, but the Deity is not therefore dirt. We again turn to Teufelsdröckh, who tells us, in an eloquent passage, "The withered leaf is not dead and lost; there are Forces in it and around it, though working in inverse order; else how could it rot? Despise not the rag from which man makes paper, or the litter from which the earth makes corn"; or, we might add, the brain tissues which produce human thought and direct human action, which fashion the kingdoms of heaven and earth, and evolve the forces by which both are overthrown.

The limitations and impatience of Carlyle's intellect are well exemplified by his total failure to penetrate the Kantian philosophy, and his final contempt of its "transcendental moonshine"—a truly ludicrous misnomer if applied to the "Kritik der reinen Vernunft." Yet here and there we find an insight into the subjective character of all our experiences, which should at least have kept him clear of dogmatic Animism. Many passages might be adduced from "Sartor Resartus," but it is in his private note-book that we find the least ambiguous and most authentic record of his intellectual gropings, sometimes guided by a sudden gleam of daylight, but always swerving sooner or later from the illumined path. Thus he says, in 1827, "For the present, I will confess it, I scarce see how we can reason with absolute certainty on the nature or fate of anything, for it seems to me we only see our perceptions and their relations; that is to say, our soul sees only its own partial reflex and manner of existing and conceiving."† Of course this is immediately followed by denunciation of "most utilitarians, moralists," and the whole tribe of "materialist metaphysicians." Again, three years later, he *thinks* he has finally "got rid of Materialism," to which his intellect must at one time have inclined, though prejudice strove successfully against its reception. It is evident that he felt the logical force of Hume's arguments, which at first deepened, but afterwards aided to nullify, this tendency. The scepticism of the great Scotch philosopher, which really denies nothing but the possibility of demonstrating first principles, seemed to him a deadly weapon with which he might slay the "mud-gods" and annihilate the "frog-spawn." Such German thought as he afterwards imperfectly

* Lord Palmerston's genial definition of "dirt" as "*Matter in the wrong place*" may be profitably contrasted with the nebulous fanaticism of Carlyle.

† Life of Carlyle, vol. i., p. 373.

assimilated confirmed this belief; and he never saw clearly that Materialism and Idealism play into each other's hands, and that while we are compelled, as a foundation for all subsequent reasoning, to postulate some independent Reality, or "*Ding an sich*," our total ignorance of its nature admonishes us to adopt the simplest and least imaginative terminology.*

The suggestive and in many respects beautiful fragment entitled "Spiritual Optics" illustrates this defect of vision. The fact that the Human is the parent of the Divine, that all supposed miracles have their being only in the mind of man,—as the apparent rotation of the heavens is due to the actual rotation of the earth, or as the onward rush of a landscape exists only in the brain of the traveller who dashes through it in an express train,—is insisted upon with strenuous eloquence. But in the following sentence springs up, with renewed vigour, that Hydra-headed fallacy which cannot be destroyed even by the keenest and brightest metaphors. "The delirious dancing of the universe is stilled, but the universe itself (what scepticism did not suspect) is still all there. God, heaven, hell, are none of them annihilated for us, any more than the material woods and houses." The analogy indicated here is a real one, but its signification may prove to be other than that contemplated by Carlyle. In his haughty neglect and scorn of Physical Science he missed certain elementary physiological truths, which lend a concrete basis to abstract Idealism. In what sense can it be said that the "material woods and houses" continue to exist? Around us the world is throbbing with its myriad pulses, varying in kind and in degree. These pulses strike the delicate epidermal surface of the body, and each, according to its kind, is taken up by a set of specially modified nerve structures. Here the distinctive character of the impulse is lost, and a uniform vibration is transmitted by distinct channels to distinct sensory ganglia. In these ganglia, and not in the external eye or ear, or in the world with which eye and ear directly communicate, are manufactured the trees and the solid earth which we behold, the blue sky, and the

* It may provoke a smile to find a professed Materialist like Prof. Tyndall a zealot in this school of Gnosticism. But Philosophy or logical consistency is not the *forte* of our genial and skilled Royal Institution Empiric. Extreme pains have been wasted in explaining to him the Hylo-phenomenal theorem of Existence, which he amusingly persists in confounding with Absolute Idealism. From the standpoint of vulgar Realism he ridicules, as mere moonshine, the sole legitimate creed of Science.—See the chapter of Lange's History of Materialism in Thomas's translation "On the Physiology of the Sense Organs and the World as Representation" (Phenomenon).

sun which illumines all. Looking yet deeper, we find that the waves of air or of ether with which we started were themselves mere intellectual representations of the unknown, fabricated in the cerebral hemispheres, and having no better claim to objective existence than the visible and tangible pageant. We must and do assume that there is "something" which exists independently of perception; but of its essence we can know nothing. If then "God, heaven, or hell, are none of them annihilated for us," they can only have their being on the same conditions as these "material woods and houses." The ideas are true so long as they claim none but ideal worth; but false when they arrogate the status of objective realities. So far from possessing any peculiar certitude, they lack even that authenticity which belongs to simple sensations, experienced by all mankind. Compounded from those impressions which are most vivid to the individual mind, inspiring the greatest terror, ecstasy, or hope, these transcendentalisms do not furnish any *rationale* of the subjective world as a whole. Other stimuli, not less real, though at present less keenly felt or less willingly remembered, are left out of the calculation.

Underlying Carlyle's fiery protestations of belief there was, as we have seen, a deep and constant scepticism. He admitted to J. S. Mill that his doctrines were incapable of logical proof, and shrank from conversing with Emerson upon the immortality of the soul. But, revolting against the philosophy of compromise and convention which characterises a sophisticated and transitional state of society, he confounded moral earnestness with religious faith, and supposed that the two were bound together in organic union. Had he carried the Clothes philosophy a step farther, he might have seen that "God" and "the Soul" are but symbols or "garments" of conscience, and that the thing typified can exist very well without its hieroglyph. Spiritual creeds are based not on too lofty, but on too low, a conception of Man and Nature. It is imagined that the visible and tangible is necessarily vile, unless animated by the Invisible, Intangible, and Unknowable. *Omne ignotum pro magnifico.* The vital interest of the known is held to lie in the idea that it is the mere vestibule of the unknown. Trees and flowers, beasts and birds, with all their beauty and complexity of structure, are either the living vestments of God or must be classed together as "dirt." The thoughts of man, however sublime or fruitful they may be, are priced as of little worth except as manifestations of an indwelling Spirit. The value of all is extrinsic, not intrinsic. Yet a

truer appreciation of the facts of life might teach us that the supposed vestibule of the temple is really the sanctuary itself, and that all seeming vistas of further glory are only reflections of its own lustre by mirrors lining its walls. No generous action or lofty principle can be less generous or lofty because it is the coinage of a material organism. No glorious landscape can be less glorious because the mind which informs it with meaning is human, not Divine. That Nature is unspeakably wonderful we not only admit, but assert, and therefore do not seek to transcend the sphere of her wonders. Carlyle characteristically says, "That the Supernatural differs not from the Natural is a great truth, which the last century (especially in France) has been engaged in demonstrating. The Philosophers went far wrong, however, in this, that instead of raising the natural to the supernatural, they strove to sink the supernatural to the natural. The gist of my whole way of thought is to do not the latter, but the former."* The fallacy of this mystification lies in the assumption that "the natural" requires to be "raised," and that human thought is capable of such a superhuman operation. Since man can know nothing but phenomena, his first attempt to realise the noumenal makes it phenomenal, and so brings it within the domain of Nature. His imaginings may certainly be vague and incoherent; they may ignore the relation of cause and effect, and may at pleasure conjoin incongruous attributes and functions; but they cannot originate anything not already present in his own character and experience. All his ideas of beauty and virtue are drawn from mundane models, and gain nothing by being transferred to an extra-mundane Divinity. The supernatural must therefore "sink" to the natural by the mere fact that it is conceived in a human mind.

In the Address recently delivered by M. Pasteur before the French Academy, and cited at the head of this article, a similar error may be detected. He justly asserts that "the idea of God is a form of the idea of the Infinite," but does not perceive that the Infinite—instead of including "more of the Supernatural than is to be found in all the miracles of all religions," is simply a synonym of Nature. It is true that we cannot represent to ourselves any "flaming wall" as the boundary of existence; but although our conceptions of the Universe are necessarily indefinite and boundless, that is surely no reason why we should prostrate ourselves before the fetich of our own ignorance, and give it a local habitation and a name.

* Life of Carlyle, vol. ii., p. 330.

Prayer—as Carlyle virtually admits—is an aspiration towards the "Type of Perfect" in ourselves, which is not impaired by the recognition of its subjective character. The feeling of immortality is in like manner independent of any actual future existence, and explained in part by our incapacity of conceiving any future event without tacitly positing ourselves as present spectators,—in part by that sense of immutable Continuity of Time and Space, unaffected by the succession of superficial impressions, which is experienced by all constant and concentrated minds.* The one absorbing subject of meditation is a fixed centre, which alone seems real, while the play and change of perceptions, whence we extract the notion of Time, is an illusive dream. "Thus, while eliminating the chimera of resurrection from the dead, and a sense of personal identity in other states of being, reason provides a complete substitute in the idea of immortality possessed by us in our present bodies."†

The two modes, already indicated, in which philosophers have sought to obey the injunction "*Know thyself*," are strikingly typified by the two modern thinkers, Carlyle and Darwin. The former indeed repudiated that maxim, in words though not in spirit, substituting for it "*Know what thou canst work at*;‡ but he was ever seeking to solve the higher problem of self-knowledge, and at last came vainly to imagine that its solution was in his hands. The intensity and the genius with which this belief was enforced are beyond all question, and the honesty with which it was held, spite of certain painful misgivings, is equally unmistakable. Yet it will scarcely be denied that this self-anointed prophet failed in his high mission. His converts to a virtually unintelligible and incoherent mysticism were at best equivocal, and perhaps he has left behind not one thoroughly assured disciple. He was a portent in the skies for a season; but

* This truth would be more generally recognised, but for that suspension of the laws of morality and common sense, as well as of physics, which seems to take place in the domain of the Supernatural. An illustration may be found in an anecdote related by Miss Martineau of Mr. W. E. Forster, the late conscientious and able Chief Secretary for Ireland. In her last letter to Mr. Atkinson (so honourably distinguished as a fearless advocate of the cause of reason and liberty of thought) she writes, "I well remember the passion with which W. E. Forster said to me 'I had rather be damned than annihilated.' If (she adds) he once felt five minutes' damnation, he would be thankful for extinction in preference." Further comment on what may be called the moral insanity thus displayed by an otherwise high-minded man is superfluous.

† Life and Mind on the Basis of Modern Medicine, by ROBERT LEWINS, M D.

‡ A formula evidently plagiarised from Goethe's 'Do the thing that lie next you.

his influence upon human welfare is not less problematic than the influence of a meteor upon the agriculture of our planet.

Far different was the destiny of that great scientific philosopher whom the world has more lately lost. Patient, modest, impartial, Darwin was not content to cross-examine Nature, and to interpret her answers in accordance with his own prepossessions; but he lived in communion with her, and disdained none of her dwellings because it was common or unclean. Every truth thus brought to light he regarded not as a solitary phenomenon, but as related to all other truths, known and unknown, and sought—still by the same method of experiment and research—to discover the grand generalisation which unites all particulars. The mind of Carlyle was medieval and theocratic, imbued with the parental Calvinism, which was practically embodied in his matured thought; that of Darwin, on the contrary, was essentially secular and modern. There was no place in his system for that remnant of Animism which Christian admirers would fain interpolate.* He himself could never have cherished the "sure and certain hope" expressed over his grave, nor could he have harboured any fear such as one would think must sometimes haunt even the clerical mind when it meditates upon the "future state" of unorthodox savants.

The theory of Natural Selection owes its epochal character to the nature of the evidence adduced in its support, and affords a perfect example of the potency of induction and the impotence of *à priori* reasoning. From the earliest times Evolution has been a constantly recurring commonplace of philosophy. Without referring to early Greek speculations, we may mention the names of Descartes, Leibnitz, De Maillet, Goethe, and Lamarck. But the principle was fruitless, because rootless. The data on which it was based were inadequate, and often fallacious, thus constituting an ingenious hypothesis rather than a sober thesis. The idea remained sterile for lack of verification. As soon, however, as fresh facts supplied this essential element of scien-

* See the Sermons preached on the occasion of his death by the Bishop of Carlisle, and by Canons Liddon and Farrar. The absence of any representative of the Royal Family at his funeral seems to imply that clearer vision is possessed by the hereditary Head of the English Church. A similar insight into the heterodoxy of the Darwinian theory was displayed by the Archbishop of York, in a Lecture delivered in St. George's Hall, May 25th, 1871. For a forcible criticism of this Lecture see the first of a series of tracts written by a well-known scholar and divine, under the pseudonym of JULIAN, for whose work Dr. Lewins stands sponsor.

tific demonstration,* Darwinism became a power which profoundly modified the direction and line of modern thought. In every department of knowledge its influence is manifest.

The moral is clear, the contrast significant. Instead of docilely surrendering himself, like Darwin, to the guidance of truth, Carlyle erected his own subjective standard in the fore front of the battle, and expected truth to follow his lead. In the pre-scientific "ages of Faith," the use of such a method was, if not a positive virtue, at least a venial sin; but at the present day it is an actual crime against Human Nature, and involves a corresponding Nemesis. Carlyle despised the spirit of the age; but the age had its revenge, and he his reward. Like the forgotten theories of Evolution, his anachronisms only represent one phase of a primæval, but quite obsolete, ideal, to which they fail to impart any fresh vitality. They, too, are without root, therefore without fruit.

II. CHARLES DARWIN: A FAREWELL OFFERING.

By An Old Disciple of Lorentz Oken.

"THE gods leave us!" We sit as if stunned by a heavy and unexpected blow, and time must pass before we fully realise what we and the world at large have lost on the 19th of April. We can scarcely believe that we shall never more open a new book from his pen, throwing a clear and startling light upon some hitherto unsolved question, or drawing important conclusions from facts heretofore ignored or despised. Many a student, many an explorer in English museums, in German laboratories, in Brazilian forests, or on Malayan coasts, when coming upon some suggestive phenomenon, will forget for the moment what has happened, and say to himself "I must let Darwin know this!"

We were all aware that Darwin was well advanced in years, and that his health was far from robust. But so necessary had he become as a leader to all earnest cultivators

* Not by Darwin alone, but also by Lyell, Haeckel, Wallace, &c. The first-named, who proved the unhistorical character of Genesis, sleeps in Westminster Abbey; of the second—pronounced Materialist though he be—Darwin has expressed the most decided approbation.

of Natural History that the probability of his end was dismissed as too painful to contemplate. We may, indeed, say to each other that his life-task was accomplished—that the doctrine of Evolution is, in its broad outlines, accepted by almost all men who are intellectually and morally capable of judging, and there but remains for his successors the easier though honourable task of working out in detail what the Great Master had planned.

Such consolations, however, seem at present almost cynical. We could all have wished that he might live on to enjoy the triumph he had won; to see the Church and the World yoke themselves side by side, as is their wont, to the chariot of success; to witness his former opponents feasting on their own words, and, best of all, to give to his followers those wise and kindly words of encouragement, of advice, or of caution, which will be remembered by many a student, and which no man living is equally competent and entitled to offer.

It is certainly cheering to note that much of the ill-will felt and the abuse uttered against the mighty dead has faded away. The "Origin of Species" is no longer classed in the *Index Expurgatorius* of the Church of Rome, which, by the way, has never formally condemned the doctrine of Evolution, and which will probably be the first of the great religious bodies to conclude a peace with the New Natural History. M. l'Abbé Moigno ("Cosmos les Mondes," April 15th, 1882, p. 580) even complains that the Academy of Sciences had closed its doors so long against "la grande, la noble figure de Darwin, parceque le système de l'Evolution n'etait pas assez orthodoxe."* Nay, we witness a strange sight: theologians and anti-theologians are respectively claiming the illustrious departed as one of themselves in a manner that recalls the mediæval legends of wars waged between angels and demons over the remains of some eminent saint. Says Canon Farrar, in a sermon preached on April 30th, in Westminster Abbey, "As a boy Darwin had been under the influence of deeply religious impressions, and there was evidence that he never lost those impressions." The preacher found in all the writings of the great naturalist "no word irreconcilable with faith in Christianity." Very similar is the contention of Canon Liddon.

On the other hand, Dr. E. B. Aveling insists that "no one knows the truth in this matter who calls the Charles

* This was a mere pretext on the part of the Academy. I suspect that the jealousy of certain of its most active members was the cause of the delay in recognising Darwin's merit.

Darwin of later years a Christian." A certain *doctrinaire* weekly organ, noted for its anti-vivisectionist leanings, records that Darwin's system has "no room for special providences or the doctrines consequent on this dogma." The writer, perhaps, forgets that the very same charge has been urged against Newton, and, due allowance being made for the difference of the subject, with equal show of reason. Fortunately it is not my duty, nor that of the "Journal of Science," to adjudicate between the saints and the sinners. That such a contest should have been raised over Darwin's grave is the best evidence of his greatness. But I cannot forget how very recently the Churches which now claim him were denouncing him, not merely as a heretic and an atheist, but as one who intentionally and consciously sought to sap the religious convictions of mankind. It is scarcely seven years since the Rev. F. O. Morris, a clergyman of the same Church as Canons Farrar and Liddon, in a pamphlet entitled "All the Articles of the Darwin Faith," put in the mouth of him whom we have just lost these very words:—"I have done all I could to make others as wretched as I am myself; I do my little best or worst to shake their faith, &c." Nor has the spirit which breathes in the lines just quoted entirely subsided. Says the "Univers"—"When hypotheses tend to nothing less than the destruction of faith, the shutting out God from the human heart and the diffusion of the filthy leprosy of Materialism, the *savant* who invents and propagates them is either a criminal or a fool. *Voilà ce que nous avons à dire du Darwin des singes.*" I certainly will not ascribe to the staff of the "Univers" a descent from apes; I should rather trace their pedigree direct to the Harpies of classic saga. Assuredly they have most wonderfully retained the ancestral habit of defiling with their *fœdissima proluvies* everything worthy of honour. Leaving, however, the "Univers" as a matter scarcely fit to be even spoken of without apology, and ignoring "La Patrie,"—less foul, though no less deluded,—let us look at home. Have we as a nation treated our great countryman, in life and in death, in a manner upon which we can look back with satisfaction? Fortunately for himself, and still more fortunately for the world, he was a man of independent means,* and hence invulnerable by the favourite weapon of modern persecution. But had he been like his father, a physician, would not his patients have been duly warned not to place themselves in

* Is it not worth noting that, like Darwin, Lyell, Buffon, Lamarck, Humboldt were gentlemen? Is, perhaps, hereditary culture necessary for the great generaliser?

the hands of so "unsound" a man? Had he by some evil star been the head-master of an endowed school, or had he held a professorship in any British university, would he not have received from those in authority a hint to resign? In any profession he would—to use one of the unhappy words of the present day—have been "Boycotted." Even when the storm of abuse and misrepresentation ceased, we had still no mark of public recognition for the greatest naturalist the world had ever known,—for the man who had made England the focus of Biology, and won for us, single-handed, the hegemony in Science. Ministries went in and out; Tories succeeded Liberals, and Liberals followed Tories, but neither party recommended him to the Sovereign as one whom it would have been a privilege to honour. Even when he was being laid to rest in that fane which holds the remains of no superior, and of few, if any, his equals, Royalty was unrepresented! I admit that Darwin—the very type of the quiet, modest, unobtrusive worker—would have set but small store on titles and orders, and that perchance he might even have declined them if offered; but for the credit of the nation, for the sake of the toiling student in every branch of Science, the offer should have been made. Never again may we have such another fellow-countryman to honour! For we must bear in mind that he was in almost every point, if not un-English, yet "un-modern English" in character and calibre. He stands in full and sharp contrast to the men before whom we bow down in reverence. Perhaps we should have appreciated him better had he been a child of the platform, greedy of opportunities for speech-making, instant in self-glorification, and prone to spice his writings with the cant of the day. It is necessary to dwell on this point for a moment, in order to understand the man who has passed from among us. As a people, we Englishmen of the latter days believe in expression rather than in conception, in rhetoric and sophistry rather than in philosophy, in words and dreams rather than in thoughts and things. We are "Geister die verneinen." We deny, dissent, disunite, and destroy. We delight in "anti" movements, leagues, and societies. Our national religion is a "protest"; our historical policy has for centuries been content to oppose what France proposed. Out "advanced thinkers" and "reformers," social, political, or theological, rarely rise above the level of barren negation. Having disproved some old dogma, overthrown some ancient institution, removed some landmark, they claim and receive worship, and leave the greater and better task—that of creating and originating—to the mercy of accident. It is sig-

nificant that the terms "reform" and "destruction" are becoming synonymous. Darwin, on the contrary, was not the "reformer," but the "reformator" of Biology. This character appears in his method of propagandism. He did not go about criticising and attacking the dogmas of the Old School, the doctrines of special mechanical creation from without, of the perfection of Nature of final causes in the animal and vegetable structure, and the like. Just as Bacon superseded the Aristotelian and Scholastic Philosophy, without deigning to enter into what might have been an endless and profitless logomachy, so Darwin spent little time in exposing the errors of the party then dominant. He did not seek to refute Agassiz, Cuvier, Paley, Linnæus, Davy, and the like. His task was to affirm and to create. It is well also to note that the same character prevails in the doctrines of the Evolutionist School. Cuvier and his disciples had held the creed of Catastrophism. According to them a great abrogation, "reform," or destruction took place every few thousand years, thus making *tabulam rasam*, and getting rid of the past with all its features and failings. This is the outcome of the negative, the "anti"-spirit. But Darwin has shown us that the great changes of Nature are effected in a different manner. The old is not destroyed at haphazard. New forms gradually spring up, supersede it, and take its place. Here, then, we have the creative, the affirmative, the originating spirit. It would be instructive and far from difficult to show that Darwin's style of controversy, if we may so call it, is at one with the doctrines he upheld, and with the processes which we see working in the world around us.

Need we therefore wonder if his researches and his writings were a stumbling-block and a stone of offence, alike to the bigoted adherents of the past and to the no less bigoted votaries of destructive changes?

Charles Darwin has been likened to the great man at whose side he sleeps, and who perhaps may be regarded as his only fitting companion in death. Both these sages have done more, much more, than merely re-organise—or rather create—some special science. Newton gave us in substance the astronomy and the natural philosophy of the present day; but he convinced mankind of the immensity of the universe;* he familiarised the world with the conception of unvarying "law" (I use the term reluctantly); he showed

* Completing the task which the great Italians, Galilei and Giordano Bruno, had begun.

us matter, not inert but active, and brought us nearer to the insight into its atomic constitution. The philosophic bearings of these onward steps do not need to be traced in detail. A new horizon was opened out to man, and the entire current of his thoughts was bound to undergo a change in as far as the teachings of the great astronomer were understood and assimilated by the people. That for this good service Newton was denounced almost as warmly and as roundly as Darwin need surprise no one.

Charles Darwin undertook a task more difficult from a threefold point of view: the subject-matter with which he had to grapple was in itself far more complicated and manifold; it was in a much more crude and imperfect state; and it was more subject to the interference of human passion and prejudice. It is not too much to say that—despite what had been done by Buffon, by Lamarck, Erasmus Darwin, St. Hilaire, and Oken—zoology, botany, and palæontology scarcely existed as sciences. The great men just mentioned had given indications of value, and had pointed towards the truth, but the world refused to listen, or heard merely to ridicule. The hour was not yet come, and the evidence collected was not sufficient. In the received text-books of natural history—the writings of Linnæus, Goldsmith, Cuvier, and the like—we found descriptions, indeed, of species, genera, and families, arranged in groups more or less unnatural. But if we asked why certain forms were present in one country, and not in another possessing an identical climate; if we wished to know whether extinct species should be introduced into surviving genera; or, in short, if we raised any of the thousand questions which every Science must answer if it seeks to make good its character as a body of correct, systematised knowledge, our teachers shook their heads and called us "närrische Jungen." If devout, they referred all these points to the inscrutable will of God: if sceptical, they accounted for everything as the outcome of "chance," and showed a plain dislike to such questioning.* But even "närrische Jungen" and "coquins curieux" could feel that a body of learning which merely appealed to the memory was no Science.

As to the prejudices of the public, they were such as the rising generation can scarcely comprehend. Men were willing to admit that in the movements of the planets—as in the fall, the motions, and the encounters of bodies upon the earth's surface—there was nothing mysterious, unaccount-

* Let no one think that I here allude to Oken.

able, or arbitrary, but merely a series of causes and effects capable of being foretold as soon as all the conditions of the case were fairly stated. But to make similar concessions with regard to the organic world* is to see the arbitrary imperilled in its last stronghold. Hence we may understand, if we cannot altogether excuse, the rancour stirred up by the "Origin of Species," and still more by the "Descent of Man." The blow given to human vanity and egotism could not be forgiven. We see, too, what Darwin has effected. He has not merely given to Natural History internal coherence, method, and object; he has made the reign of law complete in every class of phenomena; he has opened to the world a still wider horizon than that disclosed by Newton —a horizon which extends over the domains of psychology, social science, and philosophic history, with the arts founded thereon. It is doubtful if so widespread and so thorough-going a revolution was ever before effected,—effected, too, not by the destructive but by the constructive method. On this ground therefore, and quite independently of his special merits in Biology and Zoology, I claim for Darwin a philosophic rank never surpassed.

An eminent scientific man, and a personal friend of the departed, has recently compared him to Socrates. I can trace between the two thinkers few points of likeness, but rather a most striking contrast. If we look to their respective methods we find in Socrates the busy, prying gossip of a great city,—questioning, discussing, seeking truth from men, from words, and from notions and modes of thought. Nay, at times he would seem more anxious to confute than to instruct either himself or others. Darwin, though kindly and genial among friends and fellow-labourers, was the silent, patient, solitary inquirer; haunting not the streets or the market-places, but the woods, the shore, the deserts, the mountains, the garden, the laboratory; examining facts, caring little what names had been given to them by the ignorant, or what notions had heretofore been formed anent them. He was the observer, the experimentalist, the man of things as decidedly as Socrates was the dialectician, the

* It is strange and sad to note how we allow ourselves to juggle and be juggled with the words "organ," "organic," "organism," &c. If any one formally asks us the meaning of "organ," we refer him to the Greek lexicon, where he will find *'Organon* rendered "a machine, a tool, an instrument." But the next moment we forget all our etymology, and speak of the organic as a mysterious antithesis to the mechanical. The Dutch more happily make use of a word "understanded of the people." They call an organ "werk tuig" (= the German "werk zeug", and "organic nature" they term simply "*de bewerktuigde natur.*

man of talk! Had the latter lived among us he would have received not a draught of hemlock, but a peerage—perhaps the Premiership.

In the subjects of their respective studies, and in the results arrived at, the difference is even more striking. It cannot be denied that Socrates drew off attention from Physical Science. He was a despiser of Nature—of everything visible save man, and it may even be said of the human body. He formally initiated that great aberration which rendered the Greek philosophy of the latter ages so utterly unworthy of its hopeful dawn in the days of Thales, Democritus, Heraclitus, and Empedocles, which culminated in the first centuries of the Christian era, and which even yet is far from having come to an end. Men were not merely ignorant of Nature (pardon the personification); they despised and refused all physical knowledge. The words which Goethe, in the second part of "Faust," puts in the mouth of the Archbishop-Archchancellor—

> "Natur und Geist! so spricht man nicht zu Christen;
> Deshalb verbrennt man Atheisten!"

are a faithful expression of the manner in which the natural sciences and their subjects were regarded in the dark ages. We find in Socrates the germs at least of that separation of man from Nature as a something altogether heterogeneous, independent of law, of the sequence of cause and effect, and not to be introduced into any classification of the organic world. We even yet meet with such expressions as "the kingdoms of Nature and of freedom."

Among the consequences of the Socratic movement may rank all the persecutions of Science from actual executions and imprisonments, in the good old times, down to the contemptuous ill-will of so many poets, historians, novelists, journalists, metaphysicians (? anti-physicians), and fast literary men of this nineteenth century.

In the life labour of Darwin we find all this reversed. He not only showed that Nature was better worthy of study than the words, the quibbles, and the dreams of men,—in so doing he, like all followers of Science of whatever grade, simply carried out in action what Bacon had taught in precept: but he did more; he showed that man is an integral part of the organic world, capable of being understood, physically or psychically, only when regarded in that light. It has been well said that Galileo, rejecting one of the foolish antitheses of ignorant ages, "restored earth to her place in the heavens!" With equal truth it may be said that Darwin,

overturning another vain antithesis, has restored man to his place in Nature. Who can exaggerate the philosophic import of this one result—the reversal of what had been attempted by Socrates and his followers, whether Pagan or Christian, mystics or dialecticians?

In one particular point Darwin's example must be ever precious to the student. He never overlooked or despised small things. Inferior minds stray about in search of some grand, startling phenomenon, ready and willing, doubtless, to put it on record if it would only come in their way. But one of the secrets of Darwin's strength was the conviction that the continuous and ubiquitous action of apparent trifles effects more than do exceptional and catastrophic displays of power. Never was this lesson exemplified in his whole life so ably taught as in his last book on earth-worms.

He has been accused of a lack of originality, and even of injustice towards his forerunners. True the idea of Evolution was not for the first time broached in the "Origin of Species." But who, save Darwin, gave the unpopular doctrine coherence? Who collected the wonderful mass of evidence needed for its establishment, and won for it the general acceptance of the scientific world? Darwin alone. Mr. A. R. Wallace, the co-discoverer of the hypothesis of "Natural Selection," not merely admits, but avows, Darwin's superior claim. Where Buffon, Lamarck, and his own grandfather Erasmus failed to carry the world with them, he has succeeded. Hence, according to the invariable rule which awards the palm not to the suggester, but to the establisher of a truth, Charles Darwin must be hailed as the founder of the New Natural History.

Of his caution, his conscientiousness in laying before the world all facts opposed to his own theories, everyone must be fully aware. He was often his own most formidable opponent, and his gainsayers, with characteristic truthfulness, would pick certain passages out of his works, and parade them, detached from their connection, as proofs not of candour, but of vacillation or inconsistency!

With respect to the long delay in the appearance of the "Descent of Man," Darwin has been charged with reticence verging almost upon insincerity. The accusation does not, to me, appear warranted. Our great naturalist was one of the most circumspect of theorists. Even the "Origin of Species" was long kept back, while the author was accumulating further evidence and weighing its import. It is therefore, in my opinion, only natural that he should show the same circumspection on taking a second step, which, if

logically involved in the first, did not seem so to the outside world, and which indeed separated his position from that of Mr. Wallace.

Will the doctrine of Evolution retain its supremacy, or will it fade away as rapidly as it has arisen?

As regards general principles we are as likely to return to the physics of Aristoteles, to the astronomy of Ptolemy, or to the chemistry of Beccher and Stahl, as to the natural history of Cuvier. Changes of detail, in proportion to the complexity of the subject, may be looked for. It is highly probable that Natural Selection will occupy a less prominent position among the agencies determining the development of organic forms than Darwin seems to have at first considered. But such re-adjustments and additions will neither lessen the merit and the reputation of the man nor affect the world-wide influence of his conclusions. It is something to have been the contemporaries and the countrymen of Charles Darwin, and to have held even the humblest place among his followers.

III. VEGETABLE SOIL.*

By G. H. Kinahan, M.R.I.A., &c.

OVER ten years ago, in the pages of the "Geological Magazine," I published papers on the "Growth of Vegetable Soil" (1869, vol. vi., pp. 263 and 348), while in 1875 the same subject was gone over in the appendix of "Valleys and their Relations to Faults, &c." In those writings what Darwin had then published in reference to earthworms was mentioned and discussed; while evidence was given to show that this eminent observer appeared to ignore too much the soil due to vegetable growth and decay, and the work done by ants and other disturbers of the soil. It seems as if Dr. Darwin is unacquainted with these writings, as in his recently published book on "Vege-

* This paper was written prior to the death of the eminent philosopher, Dr. Darwin, and was ready for the press when his lamentable death was announced, which consequently delayed its publication.

table Mould and Earth Worms," he does not refer to any of the facts therein stated.

It appears unnecessary in this paper to repeat the facts already published in the writing above referred to, but it may be allowable to record facts since collected, especially those that bear on some of Dr. Darwin's statements, and to comment on some of the latter.

From my observations it would appear that the Irish worms are not *all the year round workers.* They generally begin their main work in September and work up to March or April in wet, soft weather, as frost or the like completely stops them. In March and April as a general rule they do very little surface work, while in April, May, June, July, and August they seem to be principally employed, if there is rain, in migrating from one place to another. But if it is dry, as is not uncommon in May and June, they retire to the deepest part of their burrows, coil themselves up, and go to sleep until the heavy showers of July come on, which penetrate down to them and gives them new life. The migration is not, however, confined to the summer months, as between September and April, during soft warm rains, they migrate considerably; to this, however, we will have to return hereafter.

These general remarks refer to the worms in the open, because in some enclosed damp place, such as walks under trees, court yards, passages, and the like, they appear to be at work oftener than elsewhere; but I do not believe that in any place they work *all the year round*, and any calculations based on such a supposition must be more or less erroneous.

The interest Dr. Darwin has taken in the earth worms seems to have prevented him observing what other animals, especially the ants, can do; and what appears very remarkable, in the writings of such an eminent and acute observer, he apportions to the worms, as will be afterwards mentioned, work that evidently was done by ants. Ants in Ireland work for about five months in the year, and during that time a colony of even the smallest kinds heap up a considerable amount of soil, while some other kinds make conspicuous hillocks; their work, however, is a mere bagatelle to the hills raised by some of the foreign ants. It must, however, be allowed that as the ants usually work during the time when grass and other herbs are growing, the work done is consolidated and kept together, and the full amount of work done is thus recorded; while earth worms only work in wet weather, at times when vegetation is slack, and consequently

much of the soil they produce is carried away and scattered by rain, runlets, and the wind.

Ants and earthworms do not work together or in general in the same kind of ground; and I strongly suspect that if surveys were made of the Irish lands where the earth worms do work, and where the ants do work, that the area of the latter would come very nearly equal to that of the first, while the soil in the ant hills would considerably exceed that in the worm casts. After these general remarks we may proceed to give some more minute details.

Worms and Grass Land.

While giving facts in this and the following divisions, a plan somewhat similar to that of Dr. Darwin's may be adopted, exact time and place being recorded; and first may be mentioned what has taken place under nearly daily observations. I am now living in a low-lying damp valley, Vale of Ovoca, Co. Wicklow, and when I came here five years ago the croquet ground was covered with a five inch thick bed of moss, the place having been uninhabited for over three years. To get rid of this moss in March, 1877, whins were heaped on it and set on fire, which burned off all the vegetation. No worm work was observed on the croquet ground until the September of 1879, after the grass began to form a regular sod. In 1880 the autumn and winter was very frosty, and the worms did very little work, but last year the autumn and winter (1881 and 1882) were very damp, and the worms have been at work nearly continuously from the end of September till February 1882. In 1881 the croquet ground was mowed early in April, and from that time till the end of September, when the wet weather stopped the lawn tennis, I did not observe a worm casting. From September, 1881, to March, 1882, the worms were very constantly at work in moist weather, especially on the worn places stopping off for days when there was no rain. On the sixth of March the croquet ground was rolled for the first time, and about once a fortnight afterwards, and after the first rolling few or no worms put up castings. The few that did were on the bare spots; they seem to have thought that the dry weather was come, and that they ought all to go to bed as they usually do in the dry weather of May and June. In the first week of April and again on the 15th, there were severe frosts, and in the rain before each there were casts, as if the worms in the grass had anticipated the cold and had left the grass tufts and again returned into the ground.

One of the adjoining walks had its edges neglected for about eighteen months, during which time the grass had encroached on the walk for from two to five inches. Three perches of one of the edges I cut myself during the first week in October, carefully examining the sods, in which I found ten seedling worms, some so small that they could scarcely be detected, and one large worm. Afraid some worms might be buried I examined the place carefully for two weeks, but not a worm came up, although the weather was most favourable for worm work, as could be seen by the daily new casts in the adjoining grass.

Many of the walks were made of "mine gravel," in which weeds will not grow, or worms burrow or creep across. In the autumn of 1880 one of these walks was coated with river gravel, and during last summer and autumn it became coated with grass, and in this grass I could not detect a worm cast or a worm when the walk was scuffled and cleaned in January. Another walk was carted over in the winter of 1880, and when cleaned in the spring, some patches of clay were left on it. On these I observed worm casts in October, which were examined, and I found that none of the worm burrows went below the clay, although on an average the patches were not more than half an inch thick. These facts appear to suggest that the growth of soil on walks and such like is not much due to worm work.

On a clayey, shady walk along the south hedge of the garden, and partially overhung by trees, the worms usually throw up cast for from seven to eight months in the year, but never in great numbers at a time.

This winter (1881—1882) has been exceptional for studying worm work in this country, as they have been able to be nearly continuously at work from the time they began in the end of September, there having been only one week of continued frost and a few other odd days that prevented their working, while in general the weather was warm and moist. Even in places where they seldom do much work, such as the upper heathery, grassy slopes of the hills, worm work this year is so conspicuous that the natives remark it, and state that there are ten worms for one of an ordinary year; the casts also are much larger. In such a field in Glenow, Co. Wicklow, about 800 feet above the sea, I found them exceptionally numerous and large, there being on an average eleven casts to the square foot, average ones having diameter and height of about 2·5 inches, while some had diameters of over 5 inches, and exceptionally tall ones had heights of 6 inches, the latter usually having small diameters

of about 2 inches, These large casts are evidently due to the mild weather, because as fast as the earth is thrown up the grass grows in it and prevents it being carried away by rain, runlets, or the wind; thus each cast appears to represent the *entire* work for the season (four months). For the four months' work in this field there has been an average of about 44 cubic inches to the square foot cast up, and if we suppose that on account of the exceptional year this is ten times the average we would have for ordinary years about 4 cubic inches to the square foot, which multiplied by 30, as the land was laid down about the year 1850, would give 120 cubic inches to the square foot, or about 0·75 of an inch added to the depth of the vegetable soil in thirty years.

The worm work in this field, as just pointed out, was excessive, so that probably 0·5 inch in the thirty years would be more correct. In either case if Dr. Darwin's theory is correct, the worm work ought now to give a considerable depth of soil, but what is rarely the case, the soil on these hill slopes rarely exceeds 3 or 4 inches in depth and often is less, and this has been the average depth for fifty years or more, the vegetable growth and decay being at a minimum. Furthermore, on following down the worm burrows they are found to be systems of nearly horizontal burrows backwards and forwards through the vegetable soil immediately over, and in no case penetrating into, the subsoil. As I pointed out in one of my previous papers, the Irish tillers of the soil usually cultivate over and over again only one stratum, and in this area it is found that in the more recently laid down land the worm burrows are principally at the bottom of that stratum, immediately above the subsoils, as if their tunnels had been made in, and in search of the decayed vegetable matter due to the turned down surfaces of the old sods. The facts observed would seem to suggest that the worms do not take from the subsoil to add it to the overlying stratum, but that they rearrange, over and over again, the vegetable soil. These notes specially refer to the slopes of the hills adjoining Glenow, but from the observations made they are also more or less applicable to the whole of the County of Wexford, and part of the County of Wicklow, let it be upland or lowland, the latter naturally having a greater depth of vegetable soil in which only the worms tunnel, unless its depth is increased by artificial means.

During the last week in March, 1882, I explored an artificial mound in a prehistoric *feartha* or burial place; worms were in the first spit (about 6 inches), but under it there were none—so much so, that one of the men remarked

hat "it could not have been placed here, as there are no worms in it." Before he spoke, as I was carefully watching every bit turned up for relics, I had myself observed the total absence of worms, which even now surprises me, as apparently the soil was very suitable for their work.

In grass during the summer, but especially in meadow land, worms seem to throw few or no casts. In the winter they have to burrow, because there is no vegetation to protect them from the cold; but this is not the case at other times, as they find sufficient shelter in the crowns of the grass and other growing plants. Go into a growing meadow with the ducks of an early morning or after rain, and you will find innumerable worms creeping about, which, as the ground gets dry from the sun, retreat, not, however, into the ground, but into the crowns of the plants; even in the summer pasture land, except when it is eaten very bare, worms in general are able to find shelter without burrowing.

I may be allowed to point out that, in making a calculation of the quantity of earth thrown up by worms, it is not correct to be always removing it, because the oftener it is removed the more vigorously they work. Leave a worm cast and a worm may not add to it for weeks, but clean away his cast day after day, thus letting the rain or other moisture into the burrow, and night after night he will cast up new earth works.

Many or most of the fields on the Wicklow hill slopes, if the rocks are slate or the like, tend to run into moss; this tendency to run into moss being very common in such areas and a great nuisance to the farmer, as it necessitates his breaking up the land. In none of these mossy fields will worm casting be found except on the tracks made by carting across them in the autumn. Where do these worms come from? Often one of these tracks will be a mile or more in length and all along it there will be numerous castings, while not one worm can be detected in the adjoining mossy fields. They may be in the moss but I could not detect them, which I ought to have been able to do, as it is not an uncommon practice to mow off "the fog," as this moss covering is locally called, and use it for the bedding of cattle, yet search the newly mown "fog" and no worms appear to be in it. It is, however, quite possible that they may have come out of the moss, because even if they were few and far between, if all of them were to migrate out of it to the sweet herbage on the beaten track, the number from the large area of moss land would appear excessive when congregated on the very limited space occupied by the track.

Worms and Tillage Land.

In the loose tillage land the worms appear to be able to run through it without having to throw up casts. In potato tillage you plant in February, March, or April, and afterwards you dig the furrows and earth, while you dig out about October. From the time you plant until you dig out you rarely see a worm cast on the surface, yet when you are digging out, the worms will be most numerous. In turnip and such like green crops, if the crops are allowed to lie long in the land, you will find some worm casts between November and February, according to the time the land is broken up, but not many if we are to judge from the few to be seen last winter (1881—1882). Yet there were plenty of them in the ground, as could be proved by digging it up, or by the innumerable surface tracks after rain. Here it may be mentioned that it would seem as if it is only from necessity they burrow, because after a turnip or mangel crop is pulled, numbers of the worms will be found under the leaves or any other kind of vegetable matter that has been left on the surface. Beans are sown in the early winter and pulled in the early autumn; usually "bean stubble" is very dirty, and when broken up is found to be full of worms, yet worm casts in bean land are few. Wheat, barley, and oats land rarely have worm casts on them, except when clover or hay seed have also been sown to lay it down. In March and April, 1882, I carefully examined the land on the Wicklow, Wexford, and Carlow hills (schist rocks), laid down the previous year, and rarely could I find a worm casting, the land not having consolidated and the worms being easily able to pass through the earth without throwing up surface mounds. On some of the land laid down two seasons there were a few but not many; the conspicuous areas for worm castings being the old consolidated grass field on which moss had not grown.

I had some land in which celery grew, which was dug up early in January and let lie till April; not a worm cast was to be seen on it, but when dug up the second time, the old manure, a spit under the surface, was full of worms.

In my present garden at Ovoca, an open one, which has a hedge and trees round three-fourths of it, I usually have two crops of early cabbage—one put down in October and the other as early as possible in February or March. The cutting of the first crop, if the weather is favourable, will be in April and May, while all will be cleared out in June or

July. While these crops are growing no worm casts are visible, but if kind rain comes on at any time, innumerable small worms appear that come up out of the ground without making casts and congregate in the young cabbage. These worms are very destructive, for although you cannot detect any eating away of the plant, yet the cabbages affected by the worm gradually dwindle away. This season (1881-2), on account of the heat and moisture, this class of worms were in excessive numbers, and so injured my October planting that the bed had to be nearly replanted in February. Not a cast will be seen on such ground, but when it is dug up after the dry weather in May and June, numerous worms will be found in the roots of the cabbage stalks, or coiled up in roundish holes from eight to fifteen inches below the surface; the latter are quite attenuated, as if they had been hybernating for some time. This occurs if you dig the cabbage beds during the dry weather usual at that time, but if you wait till the July rains come, none of the worms coiled up in the cells will be found. It is, however, quite possible, on account of the surface of such ground being friable, that worm casts are hard to detect on it, they also being friable and easily dissipated by very slight moisture; nevertheless, I suspect from what I have seen of worms that it is only through necessity that they make casts, that is, when the ground is so compact that they have to excavate tunnels through it.

The Travelling Worms.

Earth worms appear to be great travellers. After rain examine ground on which the tracks will remain, such as a road, and see the number of them and the excessive length of some of them. The tracks on a road are of two distinct kinds, one making a straight furrow and the other, although going straight, having a wriggled aspect. Examine the tracks on a road any morning after rain and the worms appear to have started from the grass at one side to get to the grass at the other; but as they rarely leave the grass exactly perpendicular to the road, their track tends more or less obliquely across it. They, however, go on straight until they meet an obstacle, from which they go straight till they meet another, so that by these different changes from their original course they often have gone 300 yards or more before they got across a road 10 yards wide. Rarely does a track run across in the shortest line, because, in addition to meeting obstacles, if there is a fall in the road they tend to go down it more or less, sometimes going straight down the

centre, while if it is level they appear—like a man walking —to side to the left hand. Sometimes when they meet a lot of obstacles they appear to have got completely bothered, and in the end to have returned to the side from whence they had started.

Worms evidently require moisture to travel; whether they travel or not every wet night it is impossible to say from the tracks, as the track may be obliterated by subsequent rain; but if there is rain in the early night the roads in the morning will have numerous tracks. After rain on a road during daylight I have rarely observed worms travelling, and that only in very sheltered places, while during dews they do not appear to travel across such places, but on land clothed with grass or other vegetation they travel in dews at night, and both by night and day after rain. The ducks know this, and in summer go looking for the worms of an early morning or after rain in the day time. From what I have observed I suspect the worms do not travel during heavy rains; it is usually in the damp heat after the rain that so many of them are about.

I have not as yet been able to learn why some tracks are smooth and straight while others are wriggled like the annelid tracks on the coal measure flags, but I suspect the wriggled tracks may be made by a different variety of worm. Usually, the worms I have watched travelling, let them be long or short, went straight, each forward movement being two-thirds the length of their body; the rate of travelling being due to whether they extend and contract the body quickly or slowly. If a worm comes to a space such as a hollow between two flags, he feels across it with the point of his body, and if he can catch on with that he will draw himself across; but if he cannot feel the other side he keeps screwing up the one-third of his body to try and elongate himself; thus often when the space to be crossed is too wide he will overbalance himself and fall down into the hollow, and if the latter is a stream or pool of water he will probably be drowned.

It has been previously mentioned that when worms set out to travel they go straight forward if they meet with no obstacle; the temporary rills and stream of water after a shower they do not appear to class among the latter, as nearly invariably they try to cross them, and thus many of them perish, they being carried down by the stream into one of the shallow pools, where afterwards numbers of them will be found dead. Many worms are also killed if the early portion of a night is wet and afterwards there is a frost,

they being caught and killed by the cold while trying to cross an exposed place such as a walk or a road. Too much heat will also kill them, as during one of those hot showery days in March last (1882), I was watching some worms crossing an open shrubbery walk, and if the sun came out suddenly and strong immediately after one of the showers some of the worms were sure to give up and lie down and die. I have also observed that on one of those hot, bright, sunshine mornings not uncommon after a wet night, many dead worms will be found on walks and such like exposed places.

Yet worms appear to be capable of travelling with great speed. In "callows," or the low-lying lands along rivers and lakes, and liable to be flooded during the rainy season, the worms appear to be able to retreat as fast as the flood rises, because at the margin of the flood they will be nearly innumerable. They also appear to be able to follow the flood as it rises and falls, and this is well known to the ducks, plover, and other wild fowl that here congregate,—not, however, solely to feed on the living worms, but also on the bodies of those that were caught by the flood, and swept by it on to its margin; but if you examine the grass at the margin of a flood, the live worms seem to far exceed the dead ones, except in the case of a perfectly bare callow, when the dead ones may be in excess.

Worms when travelling, if they meet with an obstacle rising suddenly before them, go round it if possible; while if there is a sudden fall in their path, as before mentioned, they may fall over it: thus numbers are drowned in drains and other water-courses with steep perpendicular banks. When draining land it is a common practice to test the efficiency of the drains by opening, in places between them, short cuts or pits. Into these pits numbers of travelling worms will fall, to be drowned if the bottom of the pit is of such a nature that the water will lodge in it; but if the bottom is friable the worms will burrow into it and throw up casts. I would here suggest that the worm-casts mentioned by Dr. Darwin ("Vegetable Mould and Earth Worms," pp. 184 *et seq.*) as having been thrown up by worms on the floors of Mr. Farrers's excavations, were made by worms that fell into the excavations, and not by worms that were there previously. Dr. Darwin states that, after Mr. Farrers began to take notes, it was not for five days after the floor had been cleared, and that *after a night of heavy rain* the worm burrows were observed: this is exactly what I would have expected, as, in the previously mentioned pits in the drained fields, rarely will a worm or the track of a worm be found in them until there

has been rain, after which their dead bodies or casts are found, due to travelling worms that had dropped into the pit. During the excavation of the carns of Loughcrew, Co. Meath, not a worm was to be seen; but after the floors of the chambers had been opened to the air and rain, innumerable worms flocked in, attracted by the rich soil in the floors.

When making excavations in the large crannog, Lough Rea, Co. Galway, it was found that any cut below the surface of the lake had to be bottomed at once, as otherwise the waters oozed in and flooded it. Therefore the longest cut made was opened as follows:—The first day it was opened the full length about a foot below the surface of the lake, and on our return the second day the water in it was bailed out; after which the trench was bottomed. After the trench was bailed out innumerable worms were found in it. These worms evidently could not come up from below, therefore they must have tumbled into the trench, having come out of the rich surface of the island, in which they were very numerous.

(To be continued.)

IV. EPPING FOREST FROM A NATURALIST'S POINT OF VIEW.

By Frank Fernseed.

EPPING FOREST has, it appears, been formally redeemed from the hands of encroachers, secured against all future interference, and is now thrown open for ever to the people of England. All this having been duly done, I may be permitted to ask what has thus been recovered and secured, and in what condition is it to be preserved for the use and gratification of future generations? These are questions of some importance to the public at large, and it is fitting that they should be answered aright.

There are, I am told, about 6000 acres of land which can never be contaminated by the touch of the building speculator and his familiar imps. But it must be remembered

that much of this land—certainly not less than 500 acres, and perhaps much more—has been recovered only in a very imperfect sense. To the north and east of Chingford Station there is a broad belt of country which had at one time been converted into fields. True, the fences and the gates, and all other marks of private ownership, have been removed, and the land is thrown open. But it is a mere barren waste,—treeless, shrubless, flowerless,—painful to walk over, because the ridges and depressions formed on laying it out into fields have not been removed. It is merely a desert over which the visitor has to toil as best he may till he reaches the part still covered with trees. The artist and the lover of the picturesque find here nothing on which to feast their eyes; there is nothing for the naturalist to observe, because there is no shelter for bird, reptile, or insect; lastly, there are no trees beneath which the general public may sit down to rest and meditate. What sort of "restitution" can we call this? If a man steals my dress coat, cuts off the laps, and converts it into a stable-jacket, can he be said, in any fair and just sense of the word, to have made restitution if he gives me back the damaged remains? In this matter justice has not been done. The encroachers should have been compelled to restore the land to its original condition, stocking it with the same trees, bushes, and plants as originally grew there, and to watch over their growth and well-being till thoroughly established. However, as such even-handed proceeding is not to be hoped for,—and indeed the opportunity, if it ever existed, has gone by for ever,—it is next to be asked, What prospect is there of this devastated region being restored to a condition of beauty? I fear, for the present, very little. To plant it would involve a very heavy outlay, which no public body, and certainly no private individual, will volunteer to bear. True, if it could be left untouched for a couple of centuries, trees would doubtless spring up again. The seeds of wild plants would be carried by the winds and by birds from the still unpolluted parts of the forest, and ultimately something like the original vegetation would appear. At the same time I think every observer of Nature will agree with me that if a piece of ground has been "cleared," and is then again left to itself, the new flora which gradually springs up and establishes itself is of a lower type, less beautiful and interesting, than that which has been rooted out. In the present organisation of society man might almost be defined as the cause and the creator of ugliness, and wherever he goes the ugly, in the animal and vegetable world, seems to follow his footsteps.

But even such an inferior flora of docks and nettles and thistles, of groundsel and plantain and dandelions, in lieu of the vanished primrose and cowslip, of wood-anemone and blue-bell, of sweet-briar and woodbine, will not be allowed to spring up. Under present auspices the waste must remain a waste. It is not the visitors to the forest who hinder the restorative process, but the cattle, horses, and even goats, which browse here. Every seedling is safe to be trodden down or bitten off. On the other hand, the grass, being continually eaten short, grows more compact, and its democratic organisation leaves no opening for a richly varied flora to spring up. The cattle occasion another nuisance in the forest, in addition to limiting the number of vegetable species that can flourish. There are, namely, many narrow openings in the dense bushes, forming, as it were, gateways from one sheltered glade to another. Such places are necessarily screened from sun and wind, and if there is the smallest rill or pool the cattle convert the ground into an almost impassable quagmire. Hence it is desirable that the right of pasturage should be extinguished in the forest, as well as that of lopping the trees and digging for gravel. If this can be done, and if the seeds of our native trees, shrubs, and wild flowers were liberally scattered over the ground in favourable weather, it is possible that our great-grandchildren may see these desecrated portions of the forest become once more, in old-fashioned phrase, "fit to be seen."

But independently of the restoration of these parts of the public territory, there is a very important question as to the preservation of the whole. In what state is it to be open for ever for the recreation of Her Majesty's subjects? As a specimen of free, wild forest,—a portion of England of the olden time, such as it was in the Roman and Saxon days? Or is it to be converted into something like a modern park, consisting of a stretch of grass, dotted over with trees,—possibly fine ones,—but divested of its thickets and of its multiplicity of vegetation? Certain omens lead me, as well as others, to fear that the latter view is finding favour with the Conservators. It is ominous that the pools are being drained, that a lake with artificial islands has been formed in one of the low-lying portions of the forest, that its borders are planted with shrubs quite out of keeping with the aboriginal vegetation, and that in certain parts—*e.g.*, not far from the "Woodman," at the top of Sewardstone Green—a rather extensive plot of forest has been stripped of the bushes which grew between the trees. On these subjects certain correspondence has appeared in the "Standard,"

between a gentleman who signs himself "Lepidopterist" and the Superintendent employed by the Conservators. The reply of the latter, who sneers at "sentimental" considerations, is not very reassuring. He informs the public that the Conservators are acting under the advice of one of the most experienced foresters in the United Kingdom. But what is a forester? Simply a person who understands the culture of trees so as to obtain from a given area of land the greatest amount of saleable timber. Such a man will, of course, be able to give valuable advice as to the management of a park. But it is no part of his studies, no part of his duties, to preserve woodlands in a state of Nature. The brushwood, the climbers, and the herbaceous plants he regards simply as weeds which interfere with the growth of his trees. Now, if the Forest is to be kept in its natural condition, I scarcely see that the advice of such a man can be very much needed. The Conservators ought to consult an experienced botanist, well acquainted with the life-conditions of the British flora, and able to point out the circumstances favourable to the growth of all such plants as could find in the Forest suitable localities.

The Epping Forest and Essex Naturalists' Field Club, who are well aware of what is going on around them, have taken the alarm, and have issued a very able circular pointing out the mischief which must arise if the park scheme is carried out. They show that the woodland pools which are being drained were important nurseries of many species of insects and of microscopic animalcules. If the soil is laid dry a considerable number of vegetable species which haunt swampy ground must perish. If the brushwood and the herbaceous plants disappear a profusion of insects must go, and with them the insectivorous birds. Hence the Forest will cease to afford, as heretofore, opportunities for the quiet study of bird- and insect-life. Scarcely any better arrangement could be devised to secure a rich flora and fauna than what exists ready made to our hands, and which merely wants — letting alone!

I am happy to say that the Council of the Entomological Society have added their signatures to the Memorial drawn up by the Essex Field Club, and I hope that other societies interested in the study of Natural History in its various branches will see the wisdom of doing the same. The Superintendent may, if he think proper, call all this mere "sentiment." But is not the preservation of the Forest altogether a matter of sentiment? It is not a commercial speculation, seeking to extract the greatest amount of profit

out of 6000 acres of ground. The object, as I understand, is to afford pleasure and recreation to the greatest number of the people of London.

I will venture to say that not the naturalists alone, to whatever class of society they may belong, but the toiling million of the East-end,—whom it most concerns,—would, if they could be polled on the question, vote almost in a mass for the free, wild forest, in preference to the formal park. It is therefore important that all draining and clearing operations should at once be stopped, and that money should not be spent in spoiling a place of pleasurable resort such as no European capital save Vienna has in its very outskirts.

The value of Epping Forest to the naturalist is the greater because, in addition to its size, it presents regions quite distinct from each other, both in their vegetation and in their insect inhabitants. The low swampy grounds at the Chingford end, and stretching on towards Woodford, differ totally in their productions from the centre of the Forest from High Beech, and yet again from the north-eastern extremity which extends towards Epping. There are certain insects which seem rarely to cross the road leading from Loughton to Epping. *Typhœus vulgaris*, *e.g.*, is the commonest coprophagous beetle on the right hand side of the road, especially on the high grounds above the "Robin Hood." On the left hand side of the road it is replaced by species of *Geotrupes*, especially *G. sylvaticus*. In the region stretching from Sewardstone Green towards High Beech species of *Onthophagus* become much more abundant than in either of the former districts. Whoso wishes to study the habits of the tiger-beetle (*Cicindela campestris*) must go the highest ridge of the forest at the north-eastern end,—a region full of gravel-pits. These are but a few desultory instances of the curious manner in which insect species are parcelled out within very narrow limits, and which can scarcely be studied except in ground which is left in a state of Nature. In this country there is little space which can be exempted from the three great devastating agencies—clearage, drainage, and culture. The more reason, surely, that a spot of land formally and specially reserved for the recreation of the public should be preserved from these modifying causes. There, at least, we may still hope to see the dense thicket a welcome cover for birds, and beneath which the delicate woodland flowers find a temperature often three or four degrees higher than prevails in the open fields; the sheltered glade, fenced round from all the winds of heaven, where the butterflies flit about even on chilly days; and even the occasional swamp and reedy pool,

dear to the microscopists. Those persons who are afraid of wetting their feet may turn aside and go elsewhere. But especially to the young such little obstacles are in themselves a treat. To the children whose time is spent alternately in narrow and crowded homes and in the noisy and dusty Board School,—to the older lads and lasses who see little beyond the monotonous evenness of London streets, and the grim formality of the shop and the warehouse,—a plunge through the bushes, a leap over the muddy ditch, a scramble over rough, pathless slopes, have in them a something of the adventurous which adds zest to "St. Lubbock's Day." The Forest, as it is, has scope for thousands of visitors of the most varied tastes. For the sake of the great masses, no less than of the students of Nature, I would say to the Conservators "Let well alone!"

In one point a serious mistake has been committed. It was understood that Mr. A. R. Wallace was a candidate for the Rangership of the Forest. Had this distinguished naturalist been appointed I think I may venture to say that he would have become a resident in the neighbourhood, and that his great knowledge and experience would have been brought to bear in rendering the Forest a preserve or shelter for the British flora and fauna. The Duke of Connaught has neither the special knowledge of Mr. Wallace, nor does he, as far as the public have ever learned, take any deep interest in animal and vegetable life. If he did, his other pursuits and the duties of his station would effectually prevent him from being other than a mere titular Ranger.

V. THE EXPLORATION OF PALESTINE.*

TEN years ago, the trigonometrical Survey of Palestine was commenced; it is now, as to the west, an accomplished fact. Five years ago, 4700 square miles had been surveyed, and within two years more the remaining

* I. The Great Map of Palestine.
II. The Map, in six sheets, to accompany Saunders's Introduction, Exploration Society, 1881-2.
III. An Introduction to the Survey of Western Palestine, by TRELAWNEY SAUNDERS. London: Bentley and Son, 1882.

1300 miles. The work is now crowned by the Map, measuring, as a whole, on the scale of one inch to the mile, 13 feet by 7 feet; and by the accompanying "Memoirs," with index, illustrations, plans, photographs, the native names with their signification, and the like; not yet finished, but probably reaching to ten volumes. We may add, the work has been also further completed by Mr. Saunders's "Introduction," a specialty as to waterways, plains, and highlands; the Geography of the Survey; the key to its Great Map, each essential to the other and its complement. Moreover for this "Introduction," a Special Map has been prepared, adapted to its special scientific subjects, the hydrography and the orography of the country surveyed.

Of necessity, a book of this kind, on such a subject, for such a purpose, presupposes in the reader, or rather in those who put the "Introduction" to its intended use, some previous knowledge of the bearing and incidence of the different points of physical geography it advances or establishes. Of necessity, too, it has nothing, or very little, of a popular character, though Mr. Saunders has steered clear of being too severely scientific. He has divided his subject into four parts; the natural division indicated by the country surveyed. I. The Mediterranean Watershed, with its fifteen basins, their outfalls and water-partings; taking in also the district of Mount Carmel. II. The Western Watershed of the Jordan and the Dead Sea Basin, with their numerous other basins and water-partings. Part III. treats of the plains of Western Palestine, *i.e.*, the plains on the Mediterranean slope, the plains of Galilee, the maritime plains to the south of Carmel; also the plains, lowlands, and lakes of the Jordan slope, including the Galilean Gorge, the west shore of the Sea of Galilee, the Plain of Jericho, and the like. Concluding, Part IV., with the highlands, the mountains of Upper and Lower Galilee, and the highlands of Samaria and Judæa.

It will be seen by a glance at the Map, how much all this covers, and how much the Map and this Introduction owe to each other. Both are the result of an original survey of the ground as a whole on the best scientific methods, made on actual observation, giving all the results usually desired in a topographical may. Mr. Saunders brings to his part of the work one special qualification; he had formerly laboured with Dr. Grove, before the Palestine Exploration Fund Survey, to construct a map of the Holy Land from materials then in existence; and anyone contrasting the present Map with its predecessors will at once perceive the immense

accession of details of which this book, with its capital index and table of contents, is evidence. This is the more remarkable as the physical geography of Palestine, though an object of the Exploration Society and a most valuable one, became for a time almost subordinate to the interest of the excavations in and around Jerusalem.

Not only the whole "lie" of the country and its contours, the rivers and river systems, the water discharge, the watersheds, and the drainage are placed before us complete as to the hydrography of the country, but it is also, as an orographical map, absolutely complete when supplemented by the seventy-five pages of Mr. Saunders's Part, IV., which show the relations of the streams and plains with the highlands.

Admirable as is this work, we must, however, express almost disappointment that as an "Introduction to the Survey" it omits altogether any reference to those geological causes which we venture to think would throw light on this special subject and add to its interest, as well as thus give a key to the existing formations. We will instance what we mean by a glance at the Map around Galilee. The whole of Galilee presents a country more or less disturbed by volcanic action. The whole drainage is collected by the Kishon. In the lower division, the hills are all tilted up towards the east, and broad streams of lava have flowed over the plateau above the Sea of Galilee. The inference is irresistible.

Again, remembering the salt springs which flow to the Jordan along the greater part of its course south of Beisán, and the raised beaches which have been found in various parts of the Ghór, the valley formed by a depression in the early Tertiary period was once, we cannot doubt, filled by a chain of lakes, and this, geologically, accounts for it. And yet again, considering the part which the Mediterranean Watershed occupies in Mr. Saunders's book, scientific as his arrangement rightly is, we cannot but think it would properly have admitted a geological reference to those far-off days when, as its fossils yet testify, the Mediterranean itself was a continuation of the Indian Ocean. This curious absence of geological remarks, if it does not impair the value of what is recorded, seems to leave in it almost a gap; at all events, we wish Mr. Saunders had condescended to suggest something of the kind, for the sake of the interest it imparts and the facts it establishes. We the more readily make this suggestion, as Mr. Saunders himself, lamenting the limits of his present work, adds that further investigations will follow.

Of the Great Map of Palestine (I.), it is impossible here to speak adequately. It shows the towns, villages, ruins, roads, watercourses, and buildings; tombs, caves, cisterns, wells, springs, and rock-cut olive and wine-presses. Not only are the hills delineated, but their cultivation noted; olives, figs, vines, palms distinguished; the wild growth, oak-trees, scrub, and the principal separate trees, appear; the Roman mile-stones on the roads are marked, and the many relics of antiquity; the heights of the principal features of the country are given; and the levels of the Sea of Galilee and of the Dead Sea have been fixed to within a foot.

Nor is this all, for a special edition (II.) has been prepared, reduced from the one inch map to $\frac{3}{8}$ths of an inch to the mile, illustrating the natural drainage and its divisions, and also the mountain ranges, according to the "Introduction" of Mr. Saunders. The river basins are marked and coloured, with their water-partings, and the main water-parting of the Mediterranean and Jordan watersheds. Even the minor basins,—those not extending to the main water-parting—and the small inland basins, also appear and are tinted.

Vertical sections exhibit the natural profiles of the country, according to the variations of altitude above or below the level of the sea. The ranges, the mountains, and hills are shown in colour; their heights projected on the meridional section, according to latitude, on the others according to longitude; perennial streams distinguished from dry watercourses, roads from tracks; nor is it without significance that we see the old Roman mile-stones side by side with the electric telegraph and the trigonometrical stations.

Thus has Palestine, so far as its western portion, been brought home to England by the Exploration Society, which has also now begun the same delineation eastward of the Jordan. Of the commencement of that further Eastern survey and exploration now in progress, we may hereafter give some account.

We dismiss this valuable Map—in affluence of detail, and care for accuracy and identification, comparable only to a German military map—and this admirable "Introduction," with one remark as a corollary to what we have said. The Exploration Society have done for Palestine what is yet wanting for England, where only of late are its rivers coloured blue on our Ordnance maps. We have increasing need to know the river-systems and the watersheds of our own country. Good as are now our coloured maps, they are

deficient in this; and with our growing wants for drainage and for the prevention of floods from rivers, that deficiency is a practical evil. We will instance what we have in mind. The French inundations of 1875 will be long remembered, when almost the whole of Languedoc was under water, and Toulouse was nearly destroyed. Now we know that in prehistoric times this overflow of the Garonne was prevented or greatly lessened by lakes now filled up, and that at the present day the floods are thus vastly more violent and destructive than formerly. The practical lesson is obvious.

The foundation of a geographical map is its outline, and that consists chiefly in the delineation of its waterways; a distinct acquaintance with this branch of the subject is a fundamental element of geographical knowledge. As Mr. Saunders says in his Introduction, "in tracing a watercourse from its source to its final outfall, it is found that some outfalls dispose of the waters of small areas with simple systems of watercourses; others are the drains of large areas with a great complication of watercourses not easily unravelled." It is just in this systematic examination that the Palestine Survey and its Map are so admirable, and that our Ordnance Surveys and the best contoured maps are so defective; a serious hindrance, and an impediment, at every Sanitary Board in the kingdom, when attempting the drainage of its district; for a "water-parting," be it remembered, may be as much a simple ridge, or a mere swelling of the ground between two of the smallest streams, as the natural division of the waters of a hemisphere; one of the lessons practically taught by the Map of Palestine and its "Introduction."

VI. NOTES OF EXPERIMENTS ON THE ACTION OF COLOURED LIGHT ON CARP.

By A. Anthony Nesbit, F.C.S.

IT is well known that fish alter in shade when the colour of the bottom of the water in which they live is altered, becoming darker when the bottom is darker, and lighter when the bottom is lighter. For the purpose of ascertaining whether this alteration is due only to the quantity of light—

that is, to light and shade—or whether actinic rays and the colour of the light have also an influence in producing the change, the following experiments were conducted. If they indicate nothing else, they certainly show that:—Firstly, colour is a factor in the change, as the blue produced darker fish than the black, and red had no action whatever. Secondly, that blue, the colour of the sky, and not black or green, the colour of mud and foliage, is the best and most healthy colour for carp.

First Series.

The globes intended for the reception of the carp were covered *externally* with a varnish coloured with aniline dyes. The dyes used were alkaline blue for the blue, eosine for the red, tropæoline for the yellow, and a mixture of aniline dye producing a grass green for the green. The black globes were varnished *externally* with Brunswick black, while in every case the tops were covered with large concave covers similarly coloured to the globes, air being freely admitted by the intervention of corks between the globe and cover. The carp used were the Prussian carp, *Cyprinus gibelio*.

Red.

Jan. 14*th.*—Three normally coloured carp were put into three separate globes coloured with eosine. The fish were healthy.

Jan. 21*st.*—All in good health and would feed.

Feb. 10*th.*—The three fish were removed from their globes into an uncoloured one, and on comparison with carp which had been kept in uncoloured globes for the same length of time were pronounced by four persons, making independent observations, to be unchanged in colour. They were then replaced in the red globes.

Yellow Light.

Jan. 14*th.*—Three normally coloured carp were put into three separate globes coloured with tropæoline. The fish were healthy.

Jan. 21*st.*—The fish were healthy, but paler.

Feb. 10*th.*—The fish were considered, by four persons making independent observations, to be much paler than the normally coloured.

Blue Light.

Jan. 14*th.*—Three normally coloured fish were placed in three separate globes.

Feb. 10th.—They were considered by four persons, making independent observations, to be darker than the normally coloured fish.

The carp in the blue globes became of a beautiful purplish velvety darkness, deepest on the back: their fins changed to bright red, and their whole appearance became vigorous and handsome in the extreme.

In the red and yellow globes the fins of the carp continued much the same shade of colour as their bodies, while the whole appearance of the fish was less vigorous than that of those kept in the blue globes.

Unfortunately, these fishes were attacked by a parasitic growth, and it was then observed that those carp which dwelt in the blue globes made by far the strongest resistance to the attack of disease, and did not succumb until the parasite had attained double or treble the size which caused death in the other carp.

SECOND SERIES.

Commenced April 7th, 1882.—Experiments were started on red, yellow, blue, green, and black, and also a standard of comparison in clear white glass.

Three experiments for each colour in three separate globes.

On the 14th of April they were examined, when a great change had taken place. The blue were found to be by far the darkest, to have bright red fins, and looked the most healthy. Next to the blue the black came in darkness of tint, and with fins slightly tinged with red, but were not so healthy looking. The fish in the green glass globe came next in order of darkness, while those in the red glass remained unchanged; but the fish in the yellow glass were much lighter than the standard of comparison.

The green were by far the most languid and unhealthy.

On the 21st all these fish were again observed, with the same result as on the 14th.

It will be seen that the second series of experiments fully bears out the first in demonstrating that colour is an essential factor in the health and appearance of fish.

These experiments are being prosecuted further.

ANALYSES OF BOOKS.

Dyeing and Tissue Printing. By W. CROOKES, F.R.S. (*Technological Handbooks.* Edited by H. TRUEMAN WOOD, Secretary of the Society of Arts.) London: George Bell and Sons.

THE Council of the City and Guilds Institute have felt it necessary to prepare a series of manuals specially designed for the use of students preparing for the Technological Examinations. Such works it was felt, whilst embodying the leading principles of the arts and manufactures in question, should not be too voluminous, and should above all admit of being offered at a reasonable price, so as to come within the reach of students of the working classes. Of this series the treatise before us is, we believe, the first to appear. It is a compact and closely printed volume of some 400 pages, and in conformity with the conditions laid down it contains neither illustrations of the plant and machinery used, nor patterns of dyed and printed goods. Such features, though admittedly useful, would have seriously raised the cost of the book.

The author announces that his object has been more to exhibit the general principles of the arts of dyeing and printing in their practical working than to enter into all their interminable *minutiæ*. For the latter purpose, indeed, a library rather than a manual would be needed.

As far as possible, however, within the space at disposal an attempt has been made to give the main features of the different kinds of dyeing and styles of printing. Very various methods as used in different establishments and different countries have been given. The use of the coal-tar colours which, as the author remarks, have at once "extended, simplified, and rationalised the tinctorial arts," has been shown in a number of well-selected examples.

It has been no part of the object of the work to give instructions in general chemistry. Such information, however useful or rather necessary, the students of the Institute can obtain from some of the many good and cheap manuals of chemistry which appeared of late years, and of which it would be almost invidious to name one in preference to others.

As a matter of course no book—as indeed is here fully admitted—can of itself make any man a dyer or a printer. For this purpose practical experience is necessary. But there is experience and experience. There are men who have worked for many years in dye-works and who can produce a certain round

of colours more or less successfully. But they make no improvements; they never see the way to a saving of time, labour, or materials, or to obtaining a better result. In any unusual case, such as dealing with any novel materials, they are lost. The practice and experience, therefore, must be observant and judicious if they are to lead to a true mastery of the art. It is becoming in these days more and more necessary for every artizan, especially in what may be called the more scientific branches of manufactures, to understand what are the principles of his work; to know why he does this and omits that, and what are the properties of the various agents which he has to employ. We hold that one of the greatest misfortunes which can happen to a nation is to have unobservant working men. The main object of the City and Guilds of London Institute is to assist in freeing the United Kingdom from this danger.

The work before us possesses several features which must certainly commend it to the common sense of all persons capable of judging. The language of strictly scientific circles has not been indulged in, preference being given to the briefer technical terms used in dye, print, and colour works, such terms having been, as far as we see explained, for the benefit of the learner.

After a section devoted to the principles of bleaching, Mr. Crookes treats at some length on the kinds of water to be selected for dyeing and printing, on which subject he gives very useful and practical directions. He then passes to a consideration of mordants, including those of a metallic character, the tannins, the oily bodies, and the albumenoids, This chapter is, indeed, most carefully and admirably written.

A succeeding section giving general instructions on dyeing, bears also the stamp of practical thoroughness. Great emphasis is laid upon purity and cleanliness as regards the water, the vessels, the colours to be used, and the materials to be dyed. The cautions given as to matching off and the statement of what is really expected from the dyer are thoroughly sound and judicious.

In speaking of tissue printing, Mr. Crookes calls attention to the importance of a scientific juxta-position of colours in the work produced. Neglect or want of skill in this department has, especially in former years, made English printed goods appear at a disadvantage as compared, *e.g.*, with the products of Alsace. He remarks: "Colours, in themselves excellent, may be made to look dull, flat, and ordinary, if grouped together in disregard of optical laws. On the other hand, shades which, taken singly, possess little merit, may by judicious arrangement raise and relieve each other so as to produce a very fine general effect. Hence tissue printing stands on the very boundary line between manufactures and the fine arts, and requires the co-operation of the colour-chemist, the mechanician, and the artist. Indeed the ideal manager of a print-works should combine in himself the knowledge and the resources of all the three."

These are heavy demands, but if this great branch of our national industry is to hold its own they must be fulfilled. We believe this little work will be found very widely useful, and we hope that the remainder of the treatises to appear under the auspices of the City and Guilds Institute will be conceived and executed in the same rational and practical spirit.

Private Instructions in the Science and Art of Organic Magnetism. By Miss CHANDOS LEIGH HUNT. Third Edition. London: Burns, Southampton Row.

BOOKS such as the one before us are, in more respects than one, not unlike the first journals of exploration in an unknown region. On the one hand, they rouse the curiosity even of the calmest and most judicially-disposed reader. On the other hand, they suggest the doubt, how much of what is recorded is the fruit of pure strict observation, how much is mere inference, drawn possibly from insufficient premises, and how much, possibly, is illusion? The orthodox mode of treatment for works of this class is simple and convenient: they are dismissed as the outcome of ill-regulated minds, under the influence of "dominant ideas." We can scarcely accept this method as legitimate. Illusions, even, are psychic phenomena, and it hence falls strictly within the province of Science to examine their nature, and, if possible, to explain their origin. Moreover, if only a small portion of what is stated in this volume should be true,—that is, should be a literal record of facts and a body of fairly-drawn conclusions—the subject is, both theoretically and practically, of the gravest importance.

Miss Hunt defines, or rather describes, "organic magnetism" as "an emanation arising from organisms." She calls it "organic, to distinguish it from an analogous emanation which surrounds inorganic things. This emanation can aptly be compared to a Spirit-vapour—in its most passive state it has a tendency to ascend in the atmosphere." She adds: "Its peculiar characteristics are derived from the nature of the thing from which it emanates. Some people intuitively know the character of a man, animal, or plant by sensing this emanation, upon which they found their sympathies or antipathies for its generator; they intuitively feel that a man is good or bad, an animal kindly or vicious, a plant salutary or poisonous."

Several questions here suggest themselves to the reader. Is there any "emanation" arising from organisms as a class, and to be distinguished from some other emanation which proceeds from inorganic matter? We know, of course, that many kinds

of mineral matter are more or less volatile. It is found that certain bodies commonly pronounced non-volatile have an odour, —such as caustic potash and soda. It has lately been proved that certain metals, such as lead, iron, gold, and copper, if placed near to, though not touching, plates of other metals, exert an influence upon them, which for a time alters their electric relations ("Comptes Rendus," xciv., p. 1247). But these emanations are simply minute particles of themselves.

Living organisms are the seat of more complex phenomena. In their case we are naturally reminded of the speculations of Prof. Jäger ("Journal of Science," 1880, p. 298), which, though exceedingly suggestive, and though put forward by a naturalist of good standing, lack satisfactory verification. Everyone is of course aware that animals are constantly throwing off the products of respiration and volatile matter, given off in the form of insensible perspiration. But as for any other emanation we must consider its existence, for the present, not proven. We commend the matter, however, to the attention of our readers, and any thoroughly authenticated instances will receive careful notice.

But supposing such an emanation to exist, What is its nature? Is it a form of energy, of the same order as heat, light, magnetism, or electricity, and capable of reciprocal transformation with any of these agencies? Is it a form of matter? Or is it neither matter nor energy, but in its essence spiritual? To none of these questions can a definite answer be extracted from the work before us. The words "a Spirit vapour" convey no definite meaning. The alleged tendency of this emanation to ascend in the atmosphere would seem to point to a material character. But the introduction of "will"—which, indeed, plays a prominent part throughout the work—greatly complicates the question. That either a material emanation, or a mode of energy thrown off from the body, can be made "to travel in any direction" and to an unknown distance, by an act of "will," is perfectly unthinkable, and on this point further light is urgently needed. We may mention that Dr. Kieser (not Keiser), some of whose writings Miss Hunt quotes, gave to the mesmeric or organo-magnetic emanation the name "tellurism," and regarded it as a form of energy emitted by the earth or any other planet, and opposed to the light of the sun. His treatment of the subject, when freed from the strange conceptions of the "Physiophilosophic" School, once very powerful in Germany, may perhaps pave the way to the reduction of any demonstrable phenomena belonging to "organic magnetism" under scientific laws.

There are, we learn, three kinds of magic, two of them good, and one of them evil. Of the two former, the *white* is the lower, and the *red* the higher grade. The evil, or *black*, magic is an application of the same kind of power to selfish and immoral purposes. Organic magnetism is a part, but a part only, of each of these kinds of magic. To become a red magician "fish, flesh,

fowl, alcohol, drugs, tobacco, mineral substances, and every such perversion of the natural appetite must be religiously abstained from, and your tastes therefore re-directed into their proper channels." Again, "every poisonous vegetable and every mineral drug must be strictly avoided." Without raising the question how the "natural appetite" has been ascertained, we may here ask for the definition of the terms "drugs" and "poisonous." Most fruits, leaves, &c., contain principles which may be fairly called "drugs," and which in sufficient doses are distinctly poisonous. We read on p. 7: "If you have taken many drugs, much alcohol, or tobacco, let pure and strong coffee, without chicory, enter largely into your diet as an antidote." Whilst warmly applauding the proviso "without chicory," we must not forget that caffeine, the essential alkaloid of coffee, is a drug, and in large doses a poison. Further, alcohol is not confined to fermented and distilled beverages artificially produced by man. It is now known to be a natural product, met with in small quantities in various fluids and solids. Without entering into the vegetarian controversy, we must call attention to the following passage (p. 5): "To become a Red Magician you must strictly follow Christ's laws, and imitate His life both in the letter and in the spirit." How this imitation is made to agree with the injunction to abstain from animal food we do not see.

The authoress protests against Mr. Braid's theory, and insists that "hypnotism proper and magnetism proper are not identical." The former, she considers, an exceedingly dangerous process, as may be concluded from Mr. Braid's own statement, the pulse in a subject operated upon rose to 180 beats per minute. We do not know what Miss Hunt thinks of Prof. Harting's recent cautions as to the dangers of "mesmeric" experiments to the subject operated upon. But after carefully reading Chapter IV. of the work before us, "How to become a public and private demonstrator of magnetic somnambulism," we feel strong doubts whether such demonstrations performed upon human subjects are legitimate. The experiments of Baron Dupotet, described on pp. 178 and 179, if realities, are simply horrible. Still worse are the cases given on pp. 187 and 188. To do the authoress justice, she gives very plain warnings against allowing a subject to become frightened whilst in the magnetic trance. We should, however, think that all experiments, in order to ascertain the reality, the conditions, and the laws of the imperfectly known agent in question, should be made upon the lower animals. For this purpose Miss Hunt gives very full directions. We quote the following strange passage: "The deadly effect of human saliva on poisonous snakes is positively asserted by a Georgia farmer. According to the "New York Herald," as the farmer was in a field picking up some straw, a rattlesnake, 4 feet long, fell from the straw at his feet. He set his heel on the reptile's head and spat into its mouth. In a few minutes the snake

became sick and powerless, and died in a quarter of an hour. Shortly after he caught an adder, and on following out his experiment the creature died; whilst by merely wetting a stick with his lips and drawing it across another adder's nose, the same result ensued. On spitting into the mouth of a harmless snake, however, the creature was uninjured." The poisonous character of the human saliva has been, indeed, rendered highly probable by recent investigations, but the Georgian story just quoted bears a somewhat apocryphal character. The rattlesnake might die from the bruise on its head. Or the farmer might have been chewing tobacco, the active principle of which is very rapidly fatal to serpents. It might be interesting to try the experiment upon the common viper. Only let no one make the trial in England, or he will be liable to the penalties of that national stigma, the Vivisection Act!

We rise from the study of Miss Hunt's work with the conviction that there are certain phenomena not yet formally recognised, much less explained, which require, and would doubtless repay, the prolonged and earnest study of thoroughly scientific minds. Unfortunately, in England, and we believe also in France, they have been dealt with chiefly by minds of an avowed anti-scientific tendency. The work before us will doubtless draw increased attention to this difficult subject.

"*Two Planets beyond Neptune*," 1875, and "*On some Properties of the Earth*," 1880, by O. REICHENBACH. London: Wertheimer and Lea (pub. pri.). As reviewed in a letter of Professor Klinkerfues, Director of the Gœttingen Observatory, to Mr. Warnstorff, Bookseller at Northeim.*

"THE first research which engaged my attention in the book of Count Oscar von Reichenbach, was a comparison of the whole mass of sun and planets with that gaseous mass out of which sun and planets have been formed by cooling and contracting, according to the Kant-Laplace theory.

"Under a certain hypothesis, about the original distribution of mass and density of strata in the gas-like nebula, the author arrives at the result that, compared to the latter, there still remains some mass for one or two large planets. If various things may be said against the hypothesis, Gauss, for instance, had, notwithstanding his veneration for Kant and Laplace, the objec-

* Besides the pamphlet and book reviewed, Professor Klinkerfues had in hand "Gedanken," 1857, and two articles in vol. iii. (3rd series) of the "Journal of Science," 1881, London, by O. Reichenbach, partly referring to the same subjects.

tion that Uranus is considerably more dense than Saturn, and that this is scarcely compatible with the hypothesis; spectral analysis, however, now forcibly pleads, by its results, for such a genesis of the planetary system, and it will be therefore admitted at present on the whole and in a general way. Yet the Gaussian objection is precisely, for the case in question, of great importance. For, even in meteorology, the physicist finds it an almost entirely unsolvable task to determine by calculation the density of the strata of the terrestrial atmosphere, with its height of only about 16 geographical miles, under the influence of the changes of temperature and the consequent motions. This difficulty must be increased to an enormous degree in the case of a gas-sphere some thousands of millions of miles in diameter cooling down from glow heat. In spite of all this and that, it must be admitted that the inquiry has been carried through with perspicacity and ingenuity.

"Even an antagonist of metaphysical reasoning and partisan of the inductive method may befriend himself with it on account of its euristic value. One here thinks quite spontaneously of the so-called Borde-Titius series, which became the occasion to look for a planet between Mars and Jupiter. Notwithstanding the series cannot be proved, and the result has been another and an unexpected one, it may yet not be denied that it has been useful to science. But one may also quote an example, how metaphysics may mislead on this ground. A short time after Hegel had proved in his inaugural address that there could not exist any more planets than were known at the time, a new planet was discovered, we might think as a warning for all metaphysicians and all times.

"It is not at all rare that the author of a book is proudest of what an unprepossessed criticism cannot approve. This applies (*or seems to me to apply*) to that part of the book in question, which tries to prove that the surface of the earth, also the distribution of water and land, must be exactly so constituted as it is known to be. The critic, however, can here only judge that the *à priori* proof contains more than one dark passage, and that there also exists no proposition whatever for such a demonstration. Its discovery would furnish the subject for a prize theme. *Yet a directly denying criticism I would not like to exercise*, because I am not sufficiently at home on this ground, which the author appears to be, *at least, as far as regards the material.* —Gœttingen, February 11, 1882."

Appreciating the advantage that an eminent *savant* has expressed an opinion on my work, aware that theories now famous have fared much worse, and thankfully acknowledging the regardful, antithetical, and cautious character of Prof. Klinkerfues's criticism, I point out in the interest of my views some erroneous statements and superficial readings.

It was the pamphlet which engaged the attention of the criti

by its "euristic value." Like most modern scientists, great and small, he has his fling at metaphysics. "Partisans of induction," yet unable to define and respect the boundaries with metaphysics, always over their ears in mystics, ethers ponderable and imponderable, God knows, one boxed into the other, lastly all preserved in a frictionless liquid—whatsoever that may mean—space of four and *n* dimensions, geometrically an absurdity, metaphysically a lie, and intellectually a humbug, and deeply oracular in phrases, survival of the fittest and natural selection to wit, these gentlemen blaspheme and deny their metaphysicism, be it of the revealed or of the intuitive type, as Peter did his Christ, for the occasion.

I have sometimes committed the sin of metaphysics; they are the infinite sea from which all finite science rises, and on which it must for ever float; without them we would be savages worse than brutes. If the pamphlet moves on the boundary of metaphysics and physics until the planets are seen, the book begins within the domain of physics and mechanics. Pamphlet and book contain hypotheses approved by facts, theoretical constructions and mechanical explanations of the visible, measurable, and ascertainable, according to admitted laws; they establish probabilities on deductive and inductive bases.

If the critic had read the pamphlet thoroughly, and had looked over those pages in "Gedanken" to which it refers, he would have seen that I adopt from the Kant-Laplace theory the visible nebula, without defining it as a gas at glow-heat, but that my hypothesis of the development of our solar system differs largely from that of Laplace, that it tells why Saturn is less dense than Uranus, and has room for rings and for meteors big as comets and small as the atom which was the embryo of our sun in the parental nebula. He would have seen that I wrote of the Bode-Titius series, "it is an accord falsely taken in what there is, without theoretical foundation, but it attracts our attention." He would have seen that I do not arrive at the conclusion that there still remains mass for one or two large planets, but that I speak of two and give their elements and positions with an approximation which, as predictions with a metaphysical touch, may turn out more correct than did the mathematically-accomplished deductive predictions of Adams, and even of Leverrier.

The book does not begin with an "*à priori* proof," but with an *à priori* statement of facts sufficiently striking and curious to set thinking "unprepossessed" minds thinking, but unnoticed before my time. Having thus advertised my work, as the showman the wonders in his booth, to professors, learned societies, and the "infima plebs," I explain how such facts originated, and prove how they got developed, giving a proposition and a demonstration. Discovery of such a proposition can be therefore not the "subject of a prize theme," the problem having been already solved, which does not exclude that the demonstration may be mathematically improved and spun out and occasionally marred.

I do not show "that the surface of the earth, also the distribution of sea and land, must be exactly so constituted as it is known to be," but I show why, being constituted as we know it, the regularity and organisation existing in that constitution have remained *unknown*, and how, under the operation of mechanical laws, this organisation has progressed in harmony with the development and organisation of the solar system. I point out that, starting from logical metaphysics about matter, that is gravity, and void, that is no matter, older than this book, I traced by deduction from known facts, and by application of mechanical laws, that is by induction, that certain facts should exist in connection with our earth, and then only looked for them and found that they do exist, and thus discovered that the known earth is still in many respects unknown for those who hear and see only what suits their big or small selves.

I therefore congratulate Professor Klinkerfues, who knows much more about the materials cast by me in one comprehensive mould than I "appear to know" about them, on the caution that "yet" he "would not like to exercise a directly denying criticism."

O. R.

Spon's Encyclopædia of the Industrial Arts, Manufactures, and Commercial Products. (Division V.) Edited by C. G. W. Lock, F.L.S. London and New York: E. and F. N. Spon.

The volume before us completes Messrs. Spon's great work, and we are happy to say that it shows no falling off in care taken in compilation and in the general accuracy and value of the subject matter. The test question for any work of reference like the present is simply—does it contain useful information not readily to be met with elsewhere? And to this we must return a most decided affirmative. It might often require a search of some hours in the library of the British Museum to find some desired fact which is here recorded.

Under the heading "Pigments and Paint," we find a true but somewhat humiliating reflection:—"We have only to compare a Van Eyck with a painting by a modern master—Turner for instance—to see that even the best of recent painters have not succeeded in giving to their works that durability which the originators of the method (oil painting) attained." This fact, for such it is, is a poor compliment to chemical science, and is a proof that the notion of lost arts is not something to be laughed at. Whilst making improvement in certain directions, we have been losing ground in others.

Passing over the long and elaborate articles on pottery and on

painting, we come to a treatise on resinous and gummy articles, extending to no fewer than seventy-five pages. It may, of course, be objected that there are thus included under one head products differing essentially in their chemical relations. The characters of these two groups are, however, given in detail at the outset, so that practically no inconvenience can arise. There are a few remarks on the origin of gums which were formerly supposed to be secretions. Recent investigations have proved that they are formed from the whole tissue of the cell-walls. It may, by the way, be suggested that gum is a morbid product. The writer admits that gums are yielded most abundantly when plants are in a sickly state.

Under gum arabic we find mention of a gum furnished by several Australian species of Mimosa. The trees are much more rapid in their growth than the cognate species in Africa, and there is reason to believe that the Australian gum might become the subject of a large trade, especially as its mucilage when dry is less liable to crack than that of some other kinds.

Balata, a gum-resin of the caoutchouc class, though in considerable demand, appears less and less in the market owing to the difficulty of procuring a regular supply. In America it is put to the singular purpose of a chewing material.

Under dextrine we find mention of the fact that experiments to produce dextrine from cellulose have proved failures. The attempt, however, should not be abandoned, as the value of cellulose is very much lower than that of starch, the present starting-point of the raw material. We do not see any reference to the most important impurity, sand or grit.

It is a somewhat remarkable fact that the various resins used in compounding incense seem all to contain more or less benzoic acid. It is hence possible that their original use was as disinfectants.

Concerning gutta-percha there is much interesting information. It appears that unless the tree is cultivated and a method is brought into use of collecting its milky juice without killing it, the supply must soon be at an end. The article is adulterated on the spot by the collectors. In Borneo about 20 per cent. of scraped bark is added, to which its reddish colour is due. It is even said that the Chinese middle-men who buy it from the gatherers, refuse to take it in its pure condition. Gutta-percha appears to undergo no change by twenty years exposure to sea-water, though if alternately wetted and dried, it rapidly deteriorates, a fact which has almost put an end to its use for jugs, syphons, funnels, carboys, &c.

Caoutchouc is exposed to the same peril as gutta-percha, the demand is rapidly extending, the wild supply is as rapidly decreasing, and attempts at its cultivation, though not altogether wanting, are scarcely made on the scale and with the vigour that are required.

A similar complaint must be made concerning the gum-kauri of New Zealand, as the trees are being extirpated. It is estimated that half a century will see their practical extinction, and the local government, with true English disregard of the future, takes no steps for their protection or propagation.

The article on silk is very important. It is unsatisfactory to find that India only produces one million pounds, as against six and a quarter millions from Italy and eight millions from China. Much may be hoped from the efforts made in Australia, but amidst many advantages there is in that group of colonies one important obstacle—the drying winds from the interior. In America the silk culture will meet with an impediment in the "norther" from which, probably, no part to the east of the Rocky Mountains is quite free.

In the treatise on soap it is much to be regretted that the strengths of solutions should have been expressed in Baumé's scale, which can scarcely be said to have a point in its favour.

Notwithstanding some few defects, scarcely to be avoided in a work dealing with such a range of subjects, Messers. Spon's Encyclopædia will not for a long time be superseded. The trade statistics introduced under almost every section, showing the extent of the exports or imports, and the average London prices, will be a great convenience to the commercial world. The manufacturing articles give an excellent idea of the processes now in operation, and readers of an inventive turn will often find their attention called to some desideratum offering a good scope for their ingenuity. We can only express a confident hope that the work will be highly and duly appreciated by the public.

British Fresh-Water Algæ, exclusive of the Desmidiæ and Diatomaceæ. With coloured plates by M. C. Cooke, M.A., LL.D., A.L.S. Part I. Palmellaceæ, pp. 28, 11 plates. Part II. Protococcaceæ and Volvocineæ, pp. 45, 16 plates. London: Williams and Norgate. 1882.

The best text-book on this subject, "Hassall's Fresh-Water Algæ," published in 1845, is now extremely scarce, and much of the information therein contained quite out of date, owing to the numerous discoveries made during a period of more than thirty-five years, most of which are scattered through the pages of numerous scientific periodicals. Under these circumstances, the issue of a new work on the subject cannot but prove acceptable to an increasingly large class of readers, who, thanks to the Royal Microscopical and other kindred societies, of which it is the parent, have been taught to study natural science for its own

sake and to take a deep interest in those lower forms of animal and vegetable life, of which the present work deals with some of the most interesting and important.

The author has very wisely adopted the form of publication in monographs, two of which are at present issued. For a work of so great an extent as the one now to be considered, this system has many advantages; the portions issued are complete in themselves, and the delay unavoidable where many authorities have to be consulted and numerous specimens examined, figured, and not unfrequently searched for, rendered of far less consequence than it would be in a work announced for issue at regular intervals.

The plates are especially good, and in many instances are from the author's own drawings, in which case the dimensions, as they invariably should, accompany each figure.

The life-history of some of these low forms of vegetable life is extremely interesting. The well-known *Volvox globator*, had its various stages not been traced out, would appear to be at least four or five distinct organisms, and has in earlier works been so described and figured. The subject is a very suggestive one, and promises much interesting work for the microscopist in carefully watching other forms through the whole term of their existence.

It is to be hoped that the author may be able to spare a few pages for an introduction to the study of the Fresh-Water Algæ, and also for a glossary. This will be especially welcome to those of Dr. Cooke's readers who, although ardent students of nature and skilful workers with the microscope, are in many instances but little acquainted with Greek and Latin, and will be much troubled with a terminology rendered necessary by recent advances in science, but nevertheless difficult to understand without some assistance.

The work, as far as published, bears evidence of painstaking research, althought it must of necessity be in great part a compilation of the scattered records of other observers.

Anecdota Oxoniensia, Texts, Documents, and Extracts. Chiefly from Manuscripts in the Bodleian and other Oxford Libraries. Mediæval and Modern Series. Vol I., Part. I. Sinonoma Bartholomei. Edited by J. L. G. Mowat, M.A. Oxford: Caledonian Press. London: H. Froude.

We have here a very curious glossary of botanical and medical terms as used in the fourteenth century. It forms part of a treatise on diseases and remedies written by John Mirfield

or Marfield, and bearing the title "Breviarium Bartholomei," from the monastery of St. Bartholomew's in London. The language is a curious mixture of Mediæval Latin, Arabic, and old English. In many cases the names assigned to plants and drugs would be quite unintelligible without the appended explanation. In the author's time, it appears that alcohol or alcofol signified a powder for the eyes; "abarath" stood for white lead, and "almahar" for litharge. As instances how the names of plants have changed, we may mention Ligustrum, which then signified the wildwhite convolvulus, though others used the same word for "hunnisuccles," and even for the "primerose" and "cowyslepe." Oleander was then the wild olive-tree, Gladiolus was the sweet flag or acorus. The question may be raised why the cyclamen was called by our forefathers swine's-bread, *panis porcinus*, or herthenote. The root is decidedly poisonous to man, and would probably not agree with pigs. Being mentioned more than once in this glossary under different names, it seems to have been regarded as of considerable medical importance. There is the remark appended, "nascitur in locis ubi crescunt castaneæ," referring, of course, to the sweet chestnut. The doctrine of four cardinal properties in medicinal agents, *i.e.*, heat, cold, moisture, and dryness, upon the mutual action of which their efficacy was supposed to depend, is, as a matter of course, accepted by the author. We commend this old notion to the neo-mystics of the day. It is, at least, as worthy of their notice as the notion of the four elements which they seem bent on reviving.

The Glossary may be pronounced a curious and interesting contribution to the history of medical science.

Land Nationalisation, its Necessity and its Aims. Being a Comparison of the System of Landlord and Tenant with that of Occupying Ownership in their Influence on the Wellbeing of the People. By ALFRED RUSSEL WALLACE. London: Trübner and Co.

WE are second to no man living in our respect and admiration for Mr. Wallace. But he has unfortunately chosen a subject which lies entirely outside the competence of the "Journal of Science," and which we are therefore quite unable to discuss.

Records of the Geological Survey of India. Vol. XIV., Part 2. 1881.

We find here notes of Mr. R. Lydekker, F.Z.S., on certain Gondwána Vertebrates. There is mention of the mandible of a labyrinthodont differing from any known European or American fossils hitherto known; the skull of *Gonioglyptus longirostris*, a crocodilian from the Rewah Rocks; a *Hyperodapedon* from Rewah, indicating a much larger animal than any hitherto known, and probably about 16 feet long. The same author communicates a paper on the ossiferous beds of Húndes, in Tibet, in which it appears that all the extinct Siwalik forms are absent. There are indications that the climate of Tibet must have been at one time much milder and moister than at present. Cunningham has shown that shells, now found living at heights not exceeding 11,000 feet, are found fossilised at 15,000.

In some notes on the Mining Records we find that the total yearly output of coal in India is at present only 1,000,000 tons. The writer, Mr. T. W. H. Hughes, F.G.S., comments on the exclusion of women and girls from underground employment in English mines, which if extended to India would wofully reduce the available labour. He adds, "Until education and civilisation have penetrated more deeply into the mind and system of our female Bauria and Sontal colliers, we may defer placing them on the same platform as the British miner's wife and daughter." Mr. Medlicott adds, very appositely, "or perhaps until the vices of 'civilisation' have degraded the male element of these simple people to the moral level of a large part of the British mining population."

Mr. Mallet, F.G.S., communicates an interesting paper on the Cobaltite and Danaite of the Khetri mines of Rájputana, first discovered by Mr. J. Middleton, F.G.S. The cobaltite in question is remarkable for its purity, and contains 64·64 per cent of cobalt. It is used by Indian jewellers for imparting a delicate rose-colour to gold, but the process they employ is guarded as a secret. It is remarked that mineralogical text-books disagree on the behaviour of cobaltite in the closed tube. The author finds that, whils mispickel gives a sublimate at a moderate red-heat, cobaltite and glaucodot remain unaltered until the temperature at which glass softens.

Vol. XIV., Part 3. 1881.

In this issue we find an important paper by Mr. H. B. Medlicott on Artesian Borings in India. The want of water being so frequent and disastrous, it is only natural that the attention of the Geological Survey has been turned to these wells as a possible remedy. At the French settlement of Pondicherry an excellent supply has been obtained. In other parts they have either proved

failures or the results—as in the plains of Upper India—are still indecisive. The writer very justly considers that Government ought to undertake the settlement of so momentous a question. It is a sad fact that much of the water consumed in India, by Europeans as well as natives, would in this country be condemned as unsafe.

Mr. P. N. Bose, B.Sc., F.G.S., discussing the fossil hyænas of the Siwalik, upholds the specific distinctness of *H. Sivalensis* and *H. felina*. He maintains that the measurements of the upper true molar in the "third skull" (Indian museum, No. 47), as given by Mr. Lydekker, are incorrect. Instead of 0·4×0·23 inch the dimensions should be 0·6×0·25. In *H. felina* the maximum transverse length is only 0·225, and the antero-posterior length 0·08. Hence the "third skull" does not agree in this point with *H. felina*. The latter species makes distinct approaches to the feline character, and the skull, though essentially hyænoid, cannot be brought under any known species of hyæna.

Mr. Lydekker had objected to the separation of *Machairodon Palæindicus* from *M. Sivalensis*. M. Bose replies that the difference in the structure of the lower jaw is considerable, *M. Palæindicus* departing in this respect from all other known species of the genus, *M. Sivalensis* included.

Vol. XIV., Part 4. 1881.

This issue contains important suggestions by Mr. H. B. Medlicott, on the Unification of Geological Nomenclature and Cartography. His remarks, which have been embodied in a note sent to the International Geological Congress of Bologna, relate to a very difficult question. The author points out that any attempt at a rigorous definition of signs,—whether nomenclature or the colouration of maps,—as intended for universal adoption, will be of doubtful expediency. As an instance he gives the Gondwána system of India: its base is of Permian age, and its top beds Upper Jurassic, being the homologue, though not the equivalent, of the secondary series of European geology. Yet it is a "system," and even a "formation," in the restricted sense proposed for these terms, in which no clear division over the whole area can be traced. In order to represent upon maps divisions within a system, he proposes a system of fine black lines, the direction of which is significant. A horizontal (or east—west) line is used for the lowest, and a vertical (north—south) for the highest. Four intermediately inclined lines stand for the intervening divisions. Thus six clear divisions are produced within each shade of colour, and if we take three shades for each colour we get 18 divisions for one colour. Continuous lines may be used for the primary divisions, and broken lines for the secondary.

Vol. XV., Part 1. 1882.

In this issue Mr. Lydekker, F.Z.S., gives a note on *Hyæna Sivalensis*, and shows that the skulls discovered cannot well be referred—as is done by Mr. Bose and Dr. Falconer—to two species, and that the *H. felina* of Bose must be given up. The author, however, holds that Mr. Bose was justified in his opinion by the few specimens before him.

Mr. Lydekker has studied the limb-bones and cervical vertebræ of the fossil Siwalik giraffe-like and sivatheroid animals in the Calcutta Museum. The fossil giraffe of the Siwaliks was very like the existing African species in the proportions of its limbs. Nearly approaching this giraffe is a long-limbed ruminant,—perhaps a *Vishnutherium*,—whose leg-bones are shorter than those of the true giraffe. Next follows *Hydaspitherium*, with leg-bones shorter and stouter than those of *Vishnutherium*, but longer and slighter than those of *Sivatherium*, in which the proportions are those common among ruminants. Mr. Lydekker, whilst pointing out this instructive gradation of forms, is not prepared to assert that such is the actual line of evolution of the giraffes. He considers that the families Camelopardalidæ and Sivatheridæ should be united. The skull of a large hornless ruminant from the Siwaliks, hitherto supposed to be the female of *Sivatherium giganteum*, is now referred to *Helladotherium*, and is probably the *H. Duvernoyi*. The right scapho-lunar bone of a large cat has been found in the alluvium of the Jamna. It is slightly larger than that of the Bengal tiger, but presents so little difference that it may belong to the same species. Mr. Lydekker is not disposed, without further evidence, to admit that the Pleistocene tiger was the same as that of the present day.

CORRESPONDENCE.

*** The Editor does not hold himself responsible for statements of facts or opinions expressed in Correspondence, or in Articles bearing the signature of their respective authors.

KOSMIC IDEAS: A THEME FOR THINKERS.

To the Editor of the Journal of Science.

"Look here, upon this picture, and on this;
The counterfeit presentment of two brothers."

HAMLET, *Act* 3, *Scene* 4.

First Picture.

THE scientific formula of Creation, as propounded by the Professors, is that MATTER is the predominant all, containing within itself, as self instituted, Life and Mind and Consciousness, all of which were evolved from "*the fire mist.*" Thus incandescence was the true reality; substances were separated, form eliminated, and by the action of force became phenomena,—blindly rushing hither and thither, accident became order, through its endless repetitions, and by an inherent necessity the Universe is interpreted by the senses only.

Second Picture.

Intelligence was impersonified.* God is; from whom came design and order (*i.e.*, the intimate dependence of part on part, and of each with the whole design). The impulse arose in the great arcana of thought; it was life. Light became apparent; the Universe evolved with phenomena as its incidents. In consciousness sense became knowledge by reflection.

In *Self* and *Self Interest* the difficult problem of Man is contained—for in their distinctions are Morals and Religion: in the first are all the instinctive influences; in the latter, Man's intelligence.

S. BILLING.

* Impersonified: the word is used in a figurative sense, because I know no other word which will explain my meaning; but this I may say—there is no personification excepting in intelligence, *i.e.*, in the consciousness of being.

THE LOCOMOTION OF SERPENTS.

To the Editor of The Journal of Science.

SIR,—It seems to me that the locomotion of serpents has not been sufficiently studied. Is it not probable that new light might be thrown on this subject by the use of the instantaneous photographic revolver? My reason for calling the attention of your readers to this matter is that a belief prevails in South Africa, and elsewhere, that certain snakes roll along like a hoop. A young man, just returned from the Orange Free State, tells me that he has witnessed this phenomenon; but such a mode of travelling seems so unlikely that I am exceedingly sceptical, and should like further evidence.—I am, &c.,

SERPENT-HUNTER.

ANTI-VIVISECTIONIST DOCTORS.

To the Editor of the Journal of Science.

SIR,—I should advise all medical and other scientific gentlemen who may find it their duty to watch or oppose the proceedings at Anti-Vivisection meetings to insist upon learning the qualifications of "doctors" brought forward to declare experiments upon animals useless. I have heard it hinted that some of these worthies hold diplomas not recognised in the United Kingdom. —I am, &c.

LYNX.

NOTES.

OUR attention has been called to the following letter in the "National Reformer":—"The Anti-Vivisectionists have already earned an unenviable notoriety by their reckless statements and their indifference to rigid accuracy. Another instance of this failing has occurred in reference to myself. A few days ago an official from the Society for the Prevention of Cruelty to Animals called upon me. The official was courtesy itself, but he was obliged to inform me that a communication had been received by the Society to the effect that I was in the habit of performing vivisections almost daily; that I had many students who took part in these experiments; and that many carriages, bearing fashionable ladies, came to my door. To all these statements I gave a most emphatic denial. Every one of them is entirely false. Since I have been at Newman Street I have never performed one act of vivisection. I have not that license which places scientific investigators, in one respect, on a level with tobacconists and publicans. No pupil of mine has ever seen a vivisection performed by me. The carriages and the fashionable ladies and gentlemen come to visit an estimable maker of guns who lodges beneath me. The official and Mr. Colam, the secretary, have accepted my assurance that the whole of the charge made is false. They believe that only dead animals are dissected in my laboratory. But, after the false witness and the ignominious fiasco, the fact remains that some person—certainly an untruthful anti-humanitarian—has told falsehoods in respect to myself, possibly with the object of injuring me; certainly with this result, that the opposers of scientific investigation are once more shown to be as unscrupulous as they are bitter.—EDWARD B. AVELING, D.Sc."

The conduct of Prof. E. Ray Lankester in rejecting the Chair of Natural History at Edinburgh, almost as soon as he had accepted it, is the subject of much unfavourable comment. Prof. Huxley declares that Mr. E. Ray Lankester had been fully informed of all those conditions and arrangements which he now assigns as the grounds for his resignation.

Dr. J. Crossar Ewart, heretofore Professor of Natural History at Aberdeen, takes the Chair at Edinburgh so unexpectedly vacated.

Prof. H. Alleyne Nicholson, of St. Andrews, whose works we have repeatedly had the pleasure of bringing under the notice of our readers, succeeds Prof. Ewart at Aberdeen.

We are glad to learn that public meetings are no longer so easily gulled by Anti-Vivisectionist agitators. At Sheffield a large majority of votes was given against them, and at Richmond they did not venture to submit any resolutions to a meeting which they had got together.

The "Medical Brief" is discussing the question of maternal impressions, and recording cases both where they have occurred and where they might have been expected to occur, but did not.

Intelligence of the death of Johann Karl Friedrich Zöllner, the great physical astronomer of Leipzig, did not reach us in time to be noticed in our May issue. His theory of the possible existence of a fourth dimension in space has given rise to much unworthy ridicule, and has certainly not been clearly demonstrated. But no thinking man can deny that our conception of the universe might be greatly altered if our faculties were enlarged or modified. The deceased was only in his 48th year.

Reinke ("Pflüger's Archiv") argues for the non-existence of electric currents circulating in the living cells of plants.

According to MM. Macé de Lepinay and W. Nicati ("Journal de Physique") transitory colour-blindness is produced by a stay of a few hours among snow-fields illuminated by the sun. All artificial lights appeared green for a short time. The exhaustion of the retina for the perception of red is more prolonged than for other colours.

Backlund ("Bull. de l'Académie Imp. des Sciences de St. Petersbourg") has examined the evidence for the existence of a resisting medium in space, but has arrived merely at a negative result.

The "Neues Jahrbuch für Mineralogie" contests the widely-spread notion of the archaic character of the deep-sea fauna.

M. J. Gaule ("Revue Scientifique"), on examining the red globules in the defibrinated blood of frogs, heated to 86° to 88° F. in a solution of common salt at 0·6 per cent, saw in the cellule, along with the nucleus, small movable corpuscles, elongated and pointed at their ends. These cytozoa are apparently the result of death; a part of the cellule dies totally, whilst the other becomes so much the more active, survives the cell, and becomes free.

M. Delaunay ("Les Mondes") makes some remarkable statements concerning dreams. By covering the forehead with a layer of wadding dreams can be rendered sane and rational. The position of the sleeper is also of importance. If he lies on his back the dreams will be sensorial and erotic. If on the right side they will be mobile, full of transition and exaggeration, absurd, and relating to old events. If on the left side they are intelligent, reasonable, and refer to recent affairs.

The appointment of the Fellows and Examiners of the new Royal Irish University has taken place, and has given room for no little discussion.

The medical papers give several instances of larvæ, apparently Dipterous, having been found in human subjects in this country. It is important to know whether such phenomena have been recorded formerly, or whether some Dipteron has recently become parasitic on man.

Capt. E. L. B. Davis writes to the "Popular Science Monthly" to protest against its insertion of quack advertisements. The editor, in reply, disavows responsibility for the advertisements, and hints that it would not be easy to exclude them.

Prof. Ladolei denounces as "materialistic" the opinion that plants possess sensation and will.

M. Colasanti ("Les Mondes") finds that Lepidopterous chrysalides may be submitted for forty-eight hours to a temperature of -12° C. without injury. He exposed butterflies to the same temperature, and found that on restoration to a normal temperature they all revived. On being thus frozen and restored for three successive times they became weaker.

S. Ambrogio ("Les Mondes") proposes the law that the physiological action of organic substances is "directly as their specific heat, and inversely as their molecular weight," being the reverse of the action of the metals.

Dr. Paterson, of Bridge of Allan, writes to a Glasgow paper that the mavis has, during the last thirty years, grown progressively scarcer in Scotland, and will ultimately become extinct.

Mr. R. C. Rutherford explains the phenomena of odours by the vibrations of an "odoriferous ether" analogous to, or possibly identical with, the luminiferous ether.

Prof. R. Owen has received a gold medal of honour, instituted centuries ago by the Dukes of Mantua, and of which Dante, Michael Angelo, Raphael, and Cuvier have been previous recipients.

There is a division among the Occultists. Swami Dayanund Suruswati Pundit, the elected Director and Chief of the "Theosophical Society of the Arya-Somaj," now declares that Colonel Olcott and Madame Blavatsky know nothing of occult science as practised by the Yogis of old!—*Light.*

M. Lemoine ("Comptes Rendus") gives an account of the skulls of *Arctocyon Dueilii* and *Pleuraspidotherium Ammonieri* from the lower eocene near Rheims. The former of these mammals is a carnivorous type; the latter combines the characters of the Marsupials, the Pachydermata, and the Lemuridæ. In both the quadrigeminal tubercles appear to have been completely un-

covered, and little inferior in diameter to the cerebral hemispheres —a condition approximating to that of the present crocodiles and tortoises.

Allantoine has been detected in the young leaves of the birch, horse chestnut, and plane, by E. Schulze and J. Barbieri.

From observations made by friends of the Editor in the neighbourhood of Epping Forest, the squirrel must rank among the greatest enemies of our small birds, as it destroys their eggs. It also plunders the adjacent gardens, and gnaws away the sunny side of a peach with much judgment. Its chief enemy is the carrion crow, which thus to some extent atones for its raids upon chickens and ducklings.

The crow has been seen watching a hollow tree in which the starlings have their nests. As soon as one of these birds sallied forth it was seized, stripped of its feathers, and torn to pieces. Waterton's "warrior bird" is not to be trusted.

At a recent meeting of the Quekett Microscopical Club Mr. A. D. Michael called attention to an object exhibited in the room, and illuminated with polarised light. In both animal and vegetable tissues considerable differential colouring was often evident, and this in the case of substances which had not been subjected to the more or less disturbing influences of bleaching and staining. Upon the whole Mr. Michael considered that the appearances developed by the polariscope were more natural than those produced by other means. There is little doubt that sufficient use is not made of the polariscope in the examination of tissues; in many hands it is still only a toy. In Petrology it has done wonders; rocks, sections formerly considered structureless, have shown themselves to be anything but homogeneous in their constitution.

The Quekett Microscopical Club have issued a general index to the first six volumes of their Journal, published between the years 1868 and 1881. Both author's names and subjects are alphabetically arranged, and matter elicited during discussions at the meetings is included, as well as the written papers. The index will prove useful to those engaged in the very difficult search after what has been written, as well as to members of the Club.

Under the title "Studies in Microscopical Science" a new work is announced for publication by subscription, by Mr. A. C. Cole, F.R.M.S., assisted by several eminent specialists. The most remarkable feature in the publication is the issue of a microscopical preparation, accompanied with a printed description containing the literature concerning it, the habitat, &c., the methods employed in its preparation as a means of study, its principal features, and any necessary additional remarks: there will also be a lithographed or engraved drawing or diagram of

the preparation. The first year's issue will include a series of twenty-six histological, eighteen botanical, and eight petrological preparations. There can be no doubt of the high educational value of the work. Mr. Cole's preparations are well known to students, and the list of contributors to the literary department promises well for the success of the undertaking.

At the May meeting of the Entomological Society there was exhibited a hybrid between *Antheræa Pernyi*, the oak-feeding silkworm of North China, and *A. Roylei*, an oak-feeding silkworm of the Himalayas. It was remarked that the insect fauna of North China has much stronger Himalayan affinities than that of Middle and South China. Hence the question was raised by Mr. R. McLachlan, F.R.S., whether the two parent forms, which have a very close morphological resemblance, were truly distinct species or mere local varieties.

Mr. Ryder ("American Naturalist") reports on experiments to delay the development of fish eggs for convenience of transportation. At 53° F. development was slow, but normal, up to a certain point, when a fungus was formed upon the egg-membrane. Below 53° the development became abnormal, and 43° proved fatal. Prof. Brocks finds in oyster eggs the phenomena of segmentation and nuclear division, and Mr. Ryder holds that there is a direct relation between these phenomena and heat as a mode of motion.

We are glad to see that the Dublin Society for the Prevention of Cruelty to Animals, in appealing for wider support, finds it advisable to add—"*No connection with any Anti-Vivisection Society.*" This is a healthy sign of the times.

M. H. Filhol ("Comptes Rendus") states that P. Gervais has discovered, in the Upper Eocene of Débruge, remains of a mammalian form allied to the Suidæ. This form, to which P. Gervais gives the name of *Cebochœrus*, offers analogies with the Simiadæ in the form of the molars, the elevation and the shortening of the cranium, and the form of the temporo-maxillary articulation.

The Congress of German Naturalists and Physicians will meet this year on September 17th, and the American Association for the Advancement of Science on August 23rd, at Montreal.

Sir J. Lubbock ("Journal of Linnean Society") concludes, from a prolonged and careful series of experiments, that bees distinguish colours, and have a decided preference for blue.

M. Couty, of the Museum of Rio de Janeiro, states, in a communication to the Academy of Sciences, that potassium permanganate has been recommended as an antidote to snake-poison without sufficient experimental proof. It does not annul the action of the poison when the latter has penetrated into the blood or into the tissues.

Mr. Meehan ("American Naturalist") calls attention to two forms of willow-leaves from the same tree,—one form an inch in width, and the other not more than a line,—and argues that this tends to show the production of variations by sudden leaps.

The manipulative details of Mr. J. W. Stephenson's process for mounting microscopical objects in phosphorus is published in the April number of the "Journal of the Royal Microscopical Society." The operation should on no account be attempted by any but those accustomed to the use of dangerous chemicals; the value of the results has already been noticed. The same paper also contains an account of the process of mounting in a solution of biniodide of mercury in iodide of potassium. This medium, although not so effective as the solution of phosphorus, will be found of great value, owing to its high refractive index and capability of dilution; the manipulation presents no difficulties to those used to the mounting of objects in fluid. The density of the medium is so great that flint glass floats in it like a cork.

Mrs. S. E. De Morgan, writing in the "Psychological Review," a Spiritualist organ, says—"But the Positivists and Comtists encourage feelings of benevolence, sympathy, and justice above all things, regulating and limiting the inroads of Science [!] by their dictates, and setting themselves so far in the road to truth. The enlightened Positivist, Dr. Bridges, is one of the most able writers against Vivisection."

On the other hand, "Ouida," in a rash outbreak against Vivisection, which we regret to say has been permitted to appear in the "Gentleman's Magazine," declares "that the vast and ever-increasing body of persons who are opposed to any form of religion has conceived that in encouraging Vivisection it encourages Free Thought."

Mr. T. E. Espin ("Monthly Notices of the Royal Astronomical Society") proves β Ursæ-Minoris to be a variable star, having a period of about ten and a half days. At its minimum it seems to be of a redder colour.

Prof. O. C. Marsh ("Geological Magazine") examines the wings of the Pterodactyles, and shows that they were true organs of flight, and not of natation. He gives a restored representation of *Rhamphorynchus phyllurus*.

On May 5th a lecture on poisoning with aconitine was delivered —before the Balloon Society of Great Britain!

o two
ıch in
ıt this
.

rocess
ıed in
opical
ed by
icals ;
paper
ion of
ın, al-
ill be
capa-
es to
ity of
k.

iew,"
ntists
bove
!] by
ruth.
able

Vivi-
ır in
ever-
n of
en-

nical
ng a
ems

the
gans
nta-

ered

XUM